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ROYAL BOTANIC GARDENS, KEW

XXXIV—THE VIABILITY OF SEEDS. J. H. Turner.

The problem of seed viability has long proved of interest to botanists and those engaged in any form of agriculture.

Theophrastus (1) mentions that " Of seeds some have more vitality than others as to keeping ; among the more vigorous ones are coriander, beet, leek, cress, mustard, rocket, savory . . . " and " in Cappadocia at a place called Petra they say that seed remains even for forty years fertile and fit for sowing."

Little was known about the vitality of seeds of wild plants until De Candolle, in 1832 (2), observed that " certain portions of soil, which, by reason of terracing work, were exposed to the air after several centuries, covered themselves the first year with a multitude of individuals belonging to certain species, sometimes uncommon in the vicinity." He concluded that the seeds of these species had remained viable for considerable periods in the soil.

Although much has been written regarding this subject since the time of De Candolle, the literature is very scattered and with few exceptions the accounts are based upon observations rather than experiments.

Duvel (3) has shown that the average life of seeds, as of plants, varies greatly with the different families, genera and species, but there is no relation between the longevity of plants and the viable period of the seeds they bear. Some seeds retain their power of germination for a few days only, such as the willows and poplars, others remain viable for months or even a considerable number of years. The life period of any species of seed, provided that it has been thoroughly matured, is largely dependent on environment. Climatic influences play an important part and loss of vitality is especially marked in the case of seeds stored in places of high temperature and humidity.

Only a limited number of cultivated plants produce seeds which retain their vitality for any length of time when buried in the soil, but the seeds of many plants known as " weeds " are capable of living in the soil for extended periods. Duvel (4) found that seeds of the cultivated sunflower, when buried for a year at three different depths, all decayed, whilst those of the wild sunflower retained their vitality and gave a germination of 66 per cent. at the maximum depth of 3 ft.

Many seeds are better preserved the deeper they are buried. At 3 ft. below the surface, the amount of moisture is always more

uniform, the supply of oxygen is greatly lowered and the temperature is much reduced. The majority of seeds germinate best when subjected to daily alterations in temperature, and as these alterations do not take place at a depth of 3 ft. below the surface there is a better preservation of vitality as a result of the more dormant condition of the seed.

It is well known that on the soil of old pastures and woodlands freshly turned up, or on the mud of drained ponds, plants previously unknown in that locality appear. Some of these may have arisen from seeds recently transported, but others must have grown from seeds which have lain dormant in the soil for frequently a very lengthy period. A striking illustration of this was afforded during the War by the countless plants that appeared in devastated areas. The upheaval of the ground by continuous shelling brought innumerable dormant weed seeds to the surface, where they germinated and so completely covered the ground that all appeared to be a level plain.

Hill, in the Flora of the Somme Battlefield (5), says " In July poppies [*Papaver Rhoeas* L.] predominated, and the sheet of colour as far as the eye could see was superb ; a blaze of scarlet unbroken by tree or hedgerow. Here and there long stretches of chamomile (*Matricaria Chamomilla* L.) broke into the prevailing red and monopolised some acres ; and large patches of yellow charlock were also conspicuous, but in the general effect no other plants were noticeable, though a closer inspection revealed the presence of most of the common weeds of cultivation. . . . Charlock [*Sinapis arvensis* L.] not only occurred in broad patches but was also fairly uniformly distributed, though masked by the taller poppies. Numerous small patches were, however, conspicuous and these usually marked the more recently dug graves of men buried where they had fallen. . . . No doubt in the ordinary operations of ploughing and tilling of the ground in years before the war much seed was buried which has been brought to the surface by the shelling of the ground and subsequent weathering. In this connection the presence of charlock on the more recently dug graves, where the chalk now forms the actual surface, is of interest, since it adds further proof of the longevity of this seed when well buried in the soil." The appearance of charlock on earth thrown up by shells and in shell craters when there was no trace of it on the undisturbed ground, was remarked by other botanists during the War.

Farmers often object to deep ploughing, especially on light soils as it may " bring up the charlock," and many instances are known, such as that mentioned in the Gardener's Chronicle (6). A field had been seeded down to grass and kept as a hay field and pasture. Sixteen years after the elimination of the seed source, a heavily laden wagon was taken across this field after a hard frost and thaw ; the wheels sinking deeply tore up the ground, bringing much subsoil to the surface. In the following spring these furrows were filled with

charlock, and when they flowered there were two parallel yellow ribbons marking the irregular course taken by the wagon. There was not another charlock to be seen in the field. After being under grass for 24 years, the field produced fumitory, poppies and charlock in abundance directly the surface was broken and the subsoil exposed to the atmosphere. Otherwise none of these weeds was ever seen.

Barrington (7), relates " For 60 or 70 years we have kept a book here which shows how each field has been annually cropped. . . . It occasionally happens, however, that we break old lea for a corn crop. For example, ' Wall's field ' was laid down in grass in 1869 and so remained until 1893. I well remember how surprised we were that year to see *Sinapis arvensis* . . . dotting the field of oats with yellow patches here and there."

Experiments made by Peter (8) at Göttingen show that seeds of charlock can retain their vitality in the soil for forty years, whilst Dorph-Petersen (9) found that although the germination of stored seeds of charlock after ten years was only 24 per cent., those which he had buried for the same period gave a germination of 87 per cent.

Professor E. J. Salisbury in a letter to the " Times " dated August 1st, 1932, relates that during the building of his house on former arable land, corn field weeds appeared and notably plants of the blue pimpernel (*Anagallis foemina* Mill.) a plant now exceedingly rare in that locality. These only appeared where the turf was stripped. The ground had been under hay for at least 60 years and there is little doubt that it was one of the many arable fields laid down to grass at the end of the Napoleonic wars.

Pugsley (10) mentions that *Fumaria officinalis* appeared on a heap of earth dug from the foundations of a house. The site was formerly arable land and it would seem that the seeds had lain buried ever since the field had been converted into pasture. No other flowering plant occurred on the heap.

Holmes (11) describes how a house that had been standing for about a hundred years was pulled down and the ground left vacant for a time. The following year henbane, *Hyoscyamus niger*, grew luxuriantly amongst the soil that had been exposed by clearing the foundations. " Such cases of retained vitality for a hundred years are rarely brought under notice."

There are many instances of the longevity of buried leguminous seeds. Trochu, quoted by Becquerel (12), cites that of *Ulex europaeus* which came up when trenches were dug in land which had been cleared of this plant and cultivated for 25 years. New trees were planted 15 years later, and the gorse reappeared, *i.e.*, after the seeds had been buried for 40 years.

Parkin (13) describes a similar occurrence. Gorse and heather-covered land was cleaned, drained and laid down to grass. Twenty-five years later, on ploughing the field, fresh seeds of gorse were brought to the surface and these germinated most abundantly where originally the gorse grew strongest.

Shenstone (14) mentions an interesting case of a garden in which a bush of *Ulex europaeus* had previously grown. The gorse had been removed for about 20 years, yet every year, on stirring the soil, new seedlings appeared.

Pugsley (10) describes the appearance of *Cytisus scoparius* on the bare slopes of a road cut through the grassy park-like land of Wimbledon estate. When the road was made the broom only occurred sparingly in the remoter parts of the common and there was none near the slopes. It seems probable that nearly a century ago, before the land was enclosed, the broom extended over the area now occupied by the road, and that the young plants may have originated from seed that had remained dormant for a century.

Johnson and Sowerby (15) state that plants of *Trifolium repens* often appear abundantly on land freshly brought under cultivation and that in the Fen districts white clover comes up so quickly after the land has been drained and ploughed that the inhabitants can scarcely be convinced that it is not a spontaneous product of the soil.

Ewart (16) found hard seeds of *Acacia* spp. buried deeply in the soil of Eucalyptus forests where there were no other Acacias within a mile ; he also found under trees of *Acacia dealbata*, seeds buried as deeply as 18 inches below the surface of the ground, which gave perfect germination.

C. W. James, in a letter to the " Times " of August 22nd, 1932, says " A rare example of the sudden rush to life of long-buried seeds occurred at Westonbirt a few years before Sir George Holford's death. In the winter he cleared away a quantity of *Rhododendron ponticum* in one of his woods. Next June the ground was literally blue with innumerable blossoms of the scarce *Campanula patula* of which the only specimen previously known at Westonbirt was at the edge of a wood nearly a mile away. Dr. Druce came from Oxford to see the sight and said ' I cannot believe my eyes.' The succeeding year very little of the plant was to be seen, though it had not entirely disappeared."

According to Shenstone (14) " Mr. A. B. Jackson states that when trees are grubbed up at Dawyck, Peebles, for replanting, the Foxglove springs up. It is well known that a single plant of Foxglove produces many thousands of seeds. Groups of these plants, which have probably at some time existed in the park, could easily have impregnated the soil with an abundant supply of their seeds, and subsequent groups have, no doubt, renewed the supply of seeds from time to time ; but one can scarcely resist the conclusion that the seeds must have retained their vitality for several years."

Pratt (18) records that on the Malvern hills when the soil was turned up, foxgloves sprang up plentifully. On one part which was made into a pathway, the young plants were soon crushed, but they grew up in rows on each side of the path as if they had been planted there.

O'Brien (18) cut a new walk through land that had been under grass for certainly not less than forty years. The following year mullein (*Verbascum*) came up in quantity in the disturbed soil. " It is not land where Mullein would grow wild, but the plant is used in this country (Ireland) as a remedy in consumptive cases, and it may have been cultivated long ago in some garden on this spot."

Comber (19) says " In 1897, a quantity of the large biennial *Onopordon* (Cotton Thistle) was grown in the wild garden here (at Nymans, Sussex) ; later the plants were cut down and carted to the rot-heap. This thistle has never been allowed to seed in the locality since. The decayed refuse was dug into a portion of the kitchen garden, and for twenty-five years this plant has periodically made its appearance, the seedlings being regularly destroyed with the hoe. The last plants germinated in 1927."

Peter (20) experimented with seeds from soil samples taken from forests that had been growing for known periods on formerly cultivated land. From these samples he secured the germination of numerous farm weeds, some of which, he estimated, grew from seeds that had been lying in the soil for 100 years. It is evident that weed seed can remain dormant in the soil for more than half a century. Brenchley (21) found that when grassland which had replaced arable was turned up, typical arable weeds appeared from seeds which had lain dormant in the soil for periods up to 58 years.

Probably the record longevity for any seed is that recorded by Ohga (22) who obtained approximately 100 per cent. germination with " seeds " of *Nelumbo nucifera* Gaertn. which he found on a peat bed buried two feet deep with loess in the Pulantien river valley in Southern Manchuria, the bed being 12½ metres above the present water level of the river. Judging by the age of trees of *Salix babylonica* on the bed of this former lake and from the rate of lowering of the water level, it is probable that the " seeds " are at least 120 years old and may be 400 years old or even older judging by the rate of erosion. In 1926 Ohga gave 30 of the "seeds" to the British Museum so that their viability might be tested at intervals. In 1931, Sir Arthur Hill suggested that it might be possible to grow seedlings of the *Nelumbo* at Kew and in April of that year the British Museum authorities sent two " seeds " from the Manchurian peat which they had induced to germinate. The pericarp is removed by soaking the "seed" in concentrated sulphuric acid for either 5 or 17 hours and then, after washing and keeping for a short time in water, the coat is taken off and the " seed " is kept at a temperature of 30°C. According to Ohga " In an ordinary case, when thus treated the sprout comes out after two days." The seedlings were potted and planted in the Victoria Regia pool, where they grew vigorously. The plants flowered during August 1932 and apart from the smaller flowers and seed vessels, there was nothing to distinguish them from *Nelumbo nucifera* Gaertn. raised from recent " seed." The embryo of *Nelumbo nucifera* is kept in an ideal state of quiescence by the hard

pericarp and it is this impermeability of the " seed " which no doubt is the chief factor for its prolonged vitality. Peat appears to be an ideal medium for seed preservation and its antiseptic properties prevent deterioration through fungal attack.

When the longevity of buried seeds is estimated entirely from the circumstances in which they are found, there is the possibility of error, and the only satisfactory methods of ascertaining the length of time that buried seeds will remain viable are by experiments such as those begun by Beal and Duvel in the United States.

In the autumn of 1879 Beal (23) placed twenty samples of fresh seeds of twenty-one different kinds of plants mixed with moist sand in uncorked bottles. These were inverted and buried in a row about 4 inches apart and 20 inches below the surface of the ground. At intervals of five years, from 1879–1920, one of these bottles was removed from the row and the seeds tested for germination. In 1920 the interval of testing was extended to ten years, in order that the experiment might be continued over a further sixty years. Results (24) show that after being buried for fifty years, seeds of *Brassica, Oenothera, Polygonum, Rumex* and *Verbascum* still germinate.

In 1902, Duvel (4) started an experiment under more natural conditions. Thirty-two sets of 112 samples of seeds mixed with heavy clay soil were placed in earthenware pots and covered with porous saucers. These were buried in sets at depths varying from 6 to 42 inches below the surface of the soil. A report of tests (25) made up to the year 1923 showed that of the 107 species, 51 grew and gave a good percentage of germination after being buried for twenty years. On the whole the most deeply buried seeds retained their vitality the longest.

Not only seeds buried in the earth but those submerged in mud and water have the power of resting until conditions favour germination. Salisbury (26) in a paper entitled " Vegetation of Drying Mud and Retarded Germination " states that " retarded germination is apparently dependent on the continued immersion of the seeds, whilst germination rapidly ensues after a period of desiccation. . . . Only in exceptionally dry years, or when there is a prolonged and uninterrupted exposure of mud, are the seeds sufficiently desiccated to bring about germination." He describes various instances of the appearance of aquatic colonies in dried up ponds, which, previous to the exposure of the mud were at the most of very sparse occurrence.

Guppy (27) showed that the germination of some aquatic seeds can be delayed four or five years without impairing their vitality, whilst Shull (28) proved by experiments that the seeds of many land and water plants will germinate after being kept in mud and water for periods of four to seven years.

It is evident (29) that seeds washed down from the higher reaches of a river will germinate after a prolonged submersion in salt

water, and that some seeds will withstand the action of salt water for considerable periods. Hemsley (30) relates that Guppy sent a germinating seed of *Thespesia populnea* to Kew. "This was collected fresh in the Keeling Islands in October, 1888, and kept dry until June 8th, 1890, when it was placed in sea water, where it remained floating until June 8th, 1891. It was then subjected to conditions favourable to germination, and in less than a fortnight it began to sprout and is now growing at Kew."

There are numerous instances of the germination of stored seeds. C. De Candolle (31) says "In 1850 Robert Brown, out of curiosity sowed some seeds from the collection of Sir Hans Sloane (in the British Museum), of which they had formed a part for more than a hundred and fifty years. He succeeded in making several of them germinate, particularly a seed of *Nelumbium speciosum*."

Specimens preserved in the British Museum show that Brown carried out four separate experiments with *Nelumbium* (*Nelumbo*) and that 85 per cent. of the *Nelumbium* fruits had retained their power of germination for about 150 years.

In the Journal of Botany, June 1926, Ohga described an attempt to germinate further fruits of *Nelumbium* from the Sloane Collection, but the tests were unsuccessful, and, with one exception, traces of mould were found in all the fruits examined.

"The germination of the seeds of *Nelumbium* by Robert Brown has hitherto constituted the record period of the viability not only for *Nelumbium*, but for any fruit or seed. My fruits dug out of the peat [i.e. in Southern Manchuria] are probably some centuries old, but the exact age cannot be determined until the age of the peat has been settled."

Becquerel (12) tested the germination of seeds of known age from 25 to 135 years, preserved in the Herbarium of the Natural History Museum of Paris. He found seven species, four *Leguminosae* and one each of *Malvaceae*, *Labiatae* and *Nymphaeaceae*, which retained their power of germination after 50 years. The oldest seeds found viable were :—

Cassia bicapsularis	87	years
Cytisus biflorus	84	,,
Trifolium arvense	68	,,
Lens esculenta	65	,,
Stachys nepetifolia	77	,,
Lavateria Olbia	64	,,
Nelumbium luteum	56	,,

The writer experimented with seeds collected in the Isle of Wight in 1842 by Dr. Bromfield, and also with seeds sent to Kew in 1851 by Peter Lawson & Co. These are preserved in loosely corked bottles in the Museums. The following seeds of *Leguminosae* germinated after treatment with concentrated sulphuric acid for periods of 15 to 35 minutes, according to genera.

Anthyllis vulneraria	90 years	4 per cent.	
Trifolium striatum	90 ,,	14·1 ,,	
Trifolium pratense	81 ,,	2·6 ,,	
Lotus uliginosus	81 ,,	9·6 ,,	
Melilotus alba	81 ,,	163 seeds, 1 germinated	
Cytisus scoparius	81 ,,	636 seeds, 4 germinated	
**Medicago orbicularis* at least	78 ,,	22 per cent.	
also †*Ipomoea* sp.	43 ,,	6 ,,	

The seedlings are now growing in one of the houses at Kew. Seeds of *Polygonaceae, Cruciferae, Papaveraceae* and *Scrophulariaceae* failed to germinate.

Ewart (17) experimented with over 600 different kinds of seeds originally sent in 1856 from Kew to Melbourne for the projected Botanic garden. The seeds were put aside in a dry cupboard and remained unopened until 1906. His experiments confirmed those of Becquerel, the *Leguminosae* providing more than half the number of cases of longevity. He also tested other seeds stored for periods varying up to 105 years, and was successful in germinating two out of 26 seeds of *Goodia lotifolia* and two out of 12 seeds of *Hovea heterophylla*, both 105 years old.

Ewart divided all seeds into three biological classes according to their life duration under optimal conditions. *Microbiotic*, seeds whose duration of life does not exceed 3 years ; *Mesobiotic*, which may remain viable from 3–15 years and *Macrobiotic*, seeds which may remain viable from 15 to over 100 years. This last class is " characterised by cuticularised or more or less impermeable seed coats " and " is restricted to a few natural orders, of which *Leguminosae* greatly surpass all others, while *Malvaceae* and *Myrtaceae* come next in importance." Ewart enumerated the macrobiotic families as :—*Leguminosae, Malvaceae, Myrtaceae, Nymphaeaceae, Labiatae, Iridaceae, Euphorbiaceae, Polygonaceae, Geraniaceae, Sterculiaceae, Goodeniaceae,* and *Tiliaceae.*

As a result of Beal's and Duvel's experiments the following families may be added to the list :—*Compositae, Amaranthaceae, Gramineae, Cyperaceae, Urticaceae, Caryophyllaceae, Chenopodiaceae, Phytolaccaceae, Portulacaceae, Cruciferae, Rosaceae, Onagraceae, Umbelliferae, Convolvulaceae, Verbenaceae, Solanaceae, Scrophulariaceae* and *Plantaginaceae.*

Reviewing all the available data, he formed the opinion that " However dry the seeds may be they cannot indefinitely prolong their vitality. Even the most resistant seeds after 50 to 100 years show a pronounced decrease in the percentage germination, and the general trend of the curves is such as to show that the probable

*The seeds of *Medicago orbicularis* had previously formed part of a carpological collection given to George Bentham, who, on June 29th, 1854, presented them to the Museum of the Royal Botanic Gardens.

†The seeds of *Ipomoea* were sent to Kew in 1889 for identification and had been kept in a packet for 43 years.

extreme duration of vitality for any known seed may be set between 150 and 250 years (*Leguminosae*)."

Fivaz (32) says " It would seem that Ewart, in omitting records of seeds stored in mineral soil, humus or " duff " from due consideration overlooked what may constitute optimal conditions for the preservation of vitality in seeds of some species of plants."

Fivaz shows that the seeds of *Ribes rotundifolium* may lie dormant in the forest floor for protracted periods and germinate soon after the ground is disturbed through fires, by logging operations or by the roots of trees blown down by the wind.

Gérardin (33) says " il est reconnu que des *haricots*, par exemple, que l'on auroit conservés avec soin, peuvent lever au bout de soixante ans." In a footnote he adds " J'ai semé, au printemps 1809, quelques espèces de haricots étrangers pris dans l'herbier de Tournefort, qui sont en pleines fleurs aujourd'hui 12 juillet."* He also states that seeds of *Mimosa pudica* from hermetically sealed bottles will germinate after 100 years.

Herschel (34) writes that seeds of *Acacia lophantha* germinated after being stored for 68 years. " The seeds were part of a packet received by Sir John Herschel from the Cape of Good Hope in 1843 and preserved since his death in 1871, in his cabinet." Seven plants were reared in 1910 and 1911 and a flowering specimen was presented to Kew.

Buckland (35) grew geraniums (*Pelargonium*) from seeds which had been stored away in a drawer for nearly fifty years, and in a letter to Kew dated August 2nd, 1932, Mrs. A. E. Christy states that seeds of *Reseda odorata*, put away in an envelope for at least 45 years, germinated and produced good plants.

Some of the instances of supposed seed viability are unsupported by definite evidence, and the " classical case of seed longevity " described by Heldreich was evidently founded on taxonomic errors. Heldreich puts forward the suggestion that the sudden appearance of a supposed new species which he named *Glaucium Serpieri* (shown by Dr. Turrill in K.B. 1933, 174, to be *G. flavum* var *leiocarpum*) and of *Silene juvenalis* (=*S. subconica*) in the Laurion area was due to their seeds having remained dormant for 1500 to 2000 years in the soil under the heaps of old mining debris. When the heaps were removed for re-smelting the seeds were " erst jetzt wieder zu neuem Leben zu erwachen." In the Atti, Congr. Intern. Bot. Firenze, 1874, 137 (1876) the same suggestion is sustained in the words " il est très probable que ces plantes ont été cultivées jadis par les anciens, et que leurs graines sont restées enfouies pendant des siècles sous les scories." A taxonomic investigation made by Dr. Turrill has shown that *Silene juvenalis* is conspecific with *S. subconica*, a not uncommon species in the countries around the Aegean Sea. There is nothing in the taxonomy or distribution of *S. subconica* and *G. flavum* var. *leiocarpum* to make it improbable for them to occur naturally in the

*Becquerel (12) considers that Gérardin may have been the victim of a fraud, as kidney beans do not usually remain viable for long periods.

Laurion district, and in all probability both species were in the neighbourhood before the heaps of debris were removed and simply spread on the vacated and denuded ground in the absence of close competition. " The evidence is all against either *Glaucium* or *Silene* at Laurion being examples of long enduring seed dormancy." Turrill, op. cit. 44.

There is no authenticated evidence that wheat taken from undisturbed Egyptian tombs will germinate. An experiment was made at Kew some thirty years ago with grain from a model granary, found in a tomb of the 19th dynasty and brought to England by Sir E. A. Wallis Budge. Samples were tested under various conditions and the effect of coloured glass was tried in the effort to induce germination, but after three months the grain had turned to dust. Percival (36) states " I examined a number (of grains) found by Prof. Flinders Petrie in the Graeco Roman cemetery at Hawara (about first century B.C.) . . . " the embryo had become dark brown, its plumule greatly shrivelled and little of its structure was visible."

In grain from a tomb of the 18th dynasty, 1400 B.C. " all the parts were more brittle and the embryo more completely disorganised than in the grains from Hawara. It is scarcely necessary to observe that the embryos were dead. Prof. Petrie tested samples of grain of Graeco-Roman age which he found at Hawara immediately after exhumation. The grains were sown on the banks of a canal in varying degrees of moisture . . . but none germinated."

According to Gain (37), although Egyptian wheat and barley often have an exterior appearance of good preservation, the embryo has undergone a marked chemical change and is no longer viable. This change shows that the dormant life of the grain has been long extinct.

Sir E. A. Wallis Budge has accounted for the popular belief in the germination of grain from Egyptian tombs and explains that for hundreds of years the natives of Egypt have used the halls of tombs for the wheat and barley obtained from Syria. Ancient coffins have been packed in this Syrian wheat and sent to England, and such grains will, of course, grow. During the last 30 years the native dragoman and guides have found that tourists will buy " mummy wheat " and they keep supplies in the tombs, carefully hidden, which they dig up under the eyes of the astonished visitor and offer as " mummy wheat " or " mummy barley."

Cereals are ill adapted for a prolonged period of quiescence. Sifton (38) has shown that Canadian wheat may retain its vitality for 18 years, and that the longevity of oats is greater than that of wheat, possibly owing to the protection of the hulls. Nineteen-year-old kernels of oats gave a germination of 41 per cent.

Percival (36) records an exceptional case of wheat remaining viable for twenty-five years.

White (39) found that in Australia the germination of wheat is lost after 11–16 years and that of barley after 8–10.

Fanciful tales are current with regard to "miracle" or "mummy" wheat, *Triticum turgidum* var. *mirabile* Körn and "mummy peas," *Pisum sativum* var. *umbellatum* (Mill.) Ser.

Miracle wheat is the commonest branched form of *Triticum turgidum* met with in South Europe and the North African coast. It is usually cultivated as a curiosity. Fasciated forms of the pea, similar to the so-called mummy pea, are figured by Tabernaemontanus in his Herbal published in 1590, and Miller in his Gardeners' Dictionary, 8th edit. 1771, described the form under the name of *Pisum umbellatum*, rose or crown pea.

The misleading name mummy pea is equally applied to the non-fasciated form, sometimes grown in cottage gardens. It is popularly asserted that miracle wheat and mummy peas originate from Egyptian tombs and that such seeds germinate when sown, but in every instance the statements prove to be without foundation.

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Additional Note.

An analysis of the taxonomic distribution of the 30 families listed by Mr. Turner as including species with macrobiotic seeds shows that they belong to only 15 orders. Five families of Centrospermae are represented and three of Malvales, so that over 26 per cent. of the families are grouped in two orders. This suggests that one of the characters which make macrobiotism possible—an impermeable testa or pericarp—possesses considerable taxonomic significance. The systematic list is arranged according to Engler—Gilg, Syllabus der Pflanzenfamilien ed. 9 & 10, in order to show the connection between the families of Centrospermae.

Glumiflorae : Gramineae, Cyperaceae.
Liliiflorae : Iridaceae.
Urticales : Urticaceae.
Polygonales : Polygonaceae.
Centrospermae : Chenopodiaceae, Amaranthaceae, Phytolaccaceae, Portulacaceae, Caryophyllaceae.
Ranales : Nymphaeaceae.
Rhoeadales : Cruciferae.
Rosales, suborder Rosineae : Rosaceae, Leguminosae.
Geraniales : Geraniaceae, Euphorbiaceae.
Malvales : Tiliaceae, Malvaceae, Sterculiaceae.
Myrtiflorae : Myrtaceae, Onagraceae.
Umbelliflorae : Umbelliferae.
Tubiflorae : Convolvulaceae, Verbenaceae, Labiatae, Solanaceae, Scrophulariaceae.
Plantaginales : Plantaginaceae.
Campanulatae : Goodeniaceae, Compositae.

The possession of macrobiotic seeds must be of great importance in desert areas where rain falls at intervals of several or many years. An analysis of the 414 species of Angiospermae enumerated for the desert of Atacama by Philippi (Fl. Atacam. 7–56: 1860) shows that 268 of them (approximately 65 per cent.) belong to 25 of the 30 macrobiotic families listed by Mr. Turner, the 5 other families being unrepsented. Similarly, the flora of small sandy maritime islands which has presumably been recruited largely by means of water-borne seeds and fruits should include a high proportion of those possessing an impermeable testa or pericarp, and therefore mostly belonging to the 30 families concerned. An analysis of the 84 species listed by Millspaugh (Publ. Field Columb. Mus., Bot. ii. No. 5 : 1907) for the Florida Sand Keys, shows that 58 (69 per cent.) belong to 19 of the macrobiotic families, the 11 other families being unrepresented.

The fact that macrobiotic seeds occur in five of the nine families of Centrospermae suggests that they may also be found in some of the remaining four, namely Nyctaginaceae, Cynocrambaceae, Ficoidaceae (Aizoaceae) and Basellaceae. T. A. S.

XXXV—NOTES ON AFRICAN GRASSES : XIII.*

O. Stapf & C. E. Hubbard.

Beckeropsis Pirottae (*Chiov.*) *Stapf et C. E. Hubbard*, comb. nov. *Pennisetum Pirottae* Chiov. in Ann Istit. Bot. Roma, **8**, 37, t. 2 (1903).

Distrib. Sudan and Eritrea.

Allied to *B. uniseta* (Nees) K. Schum., but with numerous (up to 12) racemes from the upper nodes, appressed slightly larger and looser spikelets and more slender culms.

Beckeropsis uniseta (*Nees*) *K. Schum.* in Engl. Pflanzenw. Ost-Afr. B. 52 (1895), in obs. *Gymnothrix uniseta* Nees, Fl. Afr. Austr. 66

*Continued from *K.B.* 1932, 152.

(1841). *Pennisetum unisetum* Benth. in Journ. Linn. Soc., Bot. **19,** 47, 49 (1881).

Distrib. Throughout tropical Africa and in Natal.

Pennisetum stenorrhachis *Stapf et C. E. Hubbard,* nom. nov. *P. tenue* Mez in Notizbl. Bot. Gart. Berlin, **7,** 53 (1917), non Fig. et De Not. (1854).

Distrib. Sudan.

Pennisetum fallax (*Fig. et De Not.*) *Stapf et C. E. Hubbard,* comb. nov. *Penicillaria fallax* Fig. et De Not. in Mem. Accad. Sci. Torino, Ser. 2, **14,** 371, fig. 29 (1854). *Pennisetum spicatum* var. *fallax* Durand & Schinz, Consp. Fl. Afr. **5,** 785 (1894). *P. americanum* forma *fallax* Leeke in Zeitschr. Naturwiss. **79,** 56 (1907). *P. spicatum* var. *vulpinum* b *fallax* Chiov. in Ann. Istit. Bot. Roma, **8,** 313 (1908).

Distrib. Sudan and Eritrea.

Pennisetum stenostachyum (*Klotzsch*) *Stapf et C. E. Hubbard,* comb. nov. *Penicillaria stenostachya* Klotzsch ex A. Br. in Ind. Sem. Hort. Berol. 1855, App. 25. *Pennisetum nigricans* var. *stenostachys* Durand & Schinz, Consp. Fl. Afr. **5,** 781 (1894). *P. americanum* forma *stenostachys* Leeke in Zeitschr. Naturwiss. **79,** 59 (1907).

Distrib. Senegal.

Pennisetum vulpinum (*A. Br.*) *Stapf et C. E. Hubbard,* comb. nov. *Penicillaria vulpina* A. Br. in Ind. Sem. Hort. Berol. 1855, App. 24. *P. spicatum* var. *vulpinum* Durand & Schinz, Consp. Fl. Afr. **5,** 786 (1894). *P. americanum* forma *vulpina* Leeke in Zeitschr. Naturwiss. **79,** 51 (1907).

Distrib. Sudan. Cultivated.

Pennisetum Sieberianum (*Schlechtd.*) *Stapf et C. E. Hubbard,* comb. nov. *Penicillaria Sieberiana* Schlechtd. in Linnaea, **25,** 565 (1852). *P. spicatum* var. *depauperatum* Aschers. et Schweinf. Illustr. Fl. Egypte, 162 (1887). *P. americanum* forma *Sieberiana* Leeke in Zeitschr. Naturwiss. **79,** 67 (1907).

Distrib. Egypt and Sudan. Cultivated.

Pennisetum pycnostachyum (*Steud.*) *Stapf et C. E. Hubbard,* comb. nov. *Cenchrus pycnostachyus* Steud. Syn. Pl. Glum. **1,** 109 (1854).

Distrib. Senegal, Gambia and Sierra Leone. Cultivated.

Pennisetum echinurus (*K. Schum.*) *Stapf et C. E. Hubbard,* sp. nov. *P. spicatum* subsp. *Willdenowii* var. *echinurus* K. Schum. in Engl. Pflanzenw. Ost-Afr. B. 55, 56 (1895). *P. typhoideum* var. *echinurum* Rendle in Cat. Afr. Pl. Welw. **2,** 191 (1899). *P. americanum* forma *echinurus* Leeke in Zeitschr. Naturwiss. **79,** 63 (1907).

Distrib. Uganda, Zanzibar, Tanganyika Territory, Nyasaland, Angola and South West Africa. Cultivated.

Pennisetum typhoides (*Burm.*) *Stapf et C. E. Hubbard*, comb. nov. *Alopecurus typhoides* Burm. Fl. Ind. 27 (1768) ; Gmelin, Syst. Nat. **2,** 167 (1791). *Penicillaria typhoides* Schlechtd. in Linnaea, **25,** 559 (1852). *Pennisetum typhoideum* L. Rich. in Pers. Syn. **1,** 72 (1805), in part.

Distrib. Sudan, Uganda, Kenya Colony, Tanganyika Territory, Belgian Congo, Nyasaland, Rhodesia, Angola, South Africa, Libya, tropical Arabia and India. Cultivated.

The commonest pearl millet of tropical East and South Africa and India.

Pennisetum subangustum (*Schumacher*) *Stapf et C. E. Hubbard*, comb. nov. *P. gracile* Benth. in Hook. Niger Fl. 564 (1849). *Panicum subangustum* Schumacher, Beskr. Guin. Pl. 59 (1827).

Distrib. Senegal, French Guinea, Sierra Leone, Southern Nigeria, Northern Nigeria, Cameroons, Belgian Congo.

Anthephora gracilis *Stapf et C. E. Hubbard*, sp. nov. ; affinis *A. truncatae* Robyns, sed culmis erectis vel geniculato-ascendentibus, spiculis majoribus, gluma inferiore ovata vel ovato-oblonga vel oblonga, seta breviore differt.

Gramen annuum. *Culmi* erecti vel geniculato-ascendentes, 45–70 cm. alti, graciles, teretes, simplices vel plerumque ramosi, 3–5-nodes, spicam versus scaberuli, ceterum glabri laevesque. *Foliorum* vaginae internodiis breviores, tenues, tenuiter striatae, inferiores carinatae, pilosae vel pubescentes, superiores sparse hirsutae vel glabrae, asperulae ; ligulae truncatae, usque ad 4 mm. longae, scariosae, auriculis vaginae angustis erectis adnatae ; laminae lineares, tenuiter acutae, usque ad 15 cm. longae, 2–4 mm. latae, planae, virides, breviter pilosae vel fere glabrae, asperulae. *Inflorescentia* spiciformis, gracilis, stricta vel flexuosa, 4–10 cm. longa, 3 mm. diametro, pallide flavido-viridis vel atroviridi- vel purpureo-variegata ; rhachis gracilis, flexuosa, triquetra, angulis minute puberulis ; rami minutissimi, cupuliformes ; fasciculi 2–3 mm. lati, subsessiles, supra medium leviter constricti, plerumque 4-spiculati. *Spiculae* 5–6 mm. longae. *Gluma* inferior spiculae aequilonga, ovata, ovato-oblonga vel oblonga, raro lanceolato-oblonga, obtusa vel subacuta, apice leviter recurva, arista scaberula erecta vel leviter patente 1·5–4 mm. longa terminata, marginibus angustis chartaceis exceptis coriacea, minute puberula, obscure 7-10–nervis ; gluma superior setaceo-subulata, 4–5 mm. longa, 1-nervis, membranacea, ciliolata. *Anthoecium inferum* ad lemma redactum : lemma lanceolato- vel ovato-oblongum, subacutum, 4–5 mm. longum, membranaceum, 3-nerve, minute puberulum, pilis paucis supra medium in nervis lateralibus obsitum. *Anthoecium superum* ♀ vel ♂ : lemma anguste ovatum, acutum, 4–4·5 mm. longum, tenuiter chartaceum, 3-nerve, dense puberulum ; palea lemmati aequilonga ; antherae fere 2 mm. longae. *Caryopsis* oblonga, 2·5 mm. longa.

Tanganyika Territory : Kondoa District ; Sambala, 1470 m., common in old cultivations, *Burtt* 2039 (type) ; Mpwapwa, Tabugwe Valley, 1140 m., in paths and glades in deciduous thicket, *Burtt* 3946.

A very distinct species, readily distinguished from the other annual African species by its awned lower glume. It is also allied to the perennial species, *A. Burttii* Stapf et C. E. Hubbard, but has shorter leaf-blades, a wider obtuse or subacute lower glume and fewer spikelets in a cluster. From the annual American species, *A. hermaphrodita* (L.) O. Kuntze, it may be separated by the narrower leaves, loose false-spikes and awned lower glume.

Beckeropsis procera *Stapf*, sp. nov. ; affinis *B. unisetae* (Nees) K. Schum., sed culmis tenuioribus, laminis angustioribus, spiculis majoribus differt.

Gramen perenne, 60–150 cm. altum, e rhizomate brevi praemorso ortum ; gemmae innovationum acutae, squamis firmis ovatis laevibus glabris praeditae. *Culmi* erecti, 1–3 mm. lati, e nodis superioribus ramosi vel inferne simplices, nodis ad 14, plus minusve teretes, laeves, glabri, pallidi, nonnunquam glauci, internodio longissimo usque ad 25 cm. longo. *Foliorum* vaginae validae, inferiores et mediae internodiis aequilongae vel breviores, arcte appressae, pallidae, glabrae laevesque, basales plerumque purpureo-suffusae ; ligulae breves, ciliatae ; laminae lineares, raro e basi angusta petiolata saepe longa lineari-lanceolatae, in apicem setaceum longe attenuatae, usque ad 45 cm. longae et ad 4–8 mm. latae, superiores multo angustiores et fere filiformes, tenues, pallide virides, marginibus tenuiter scaberulis et nonnunquam facie exceptis laeves, glabrae. *Racemi* solitarii vel pluri-fasciculati, usque ad 4·5 cm. longi, pedunculis longis filiformibus ; rhachis gracillima, leviter angulata et scaberula ; pedicelli usque ad 1·5 mm. longi ; seta basalis usque ad 2·5 cm. longa. *Spiculae* plerumque laxe vel laxissime imbricatae, oblongo-lanceolatae, acutae vel apiculato-acuminatae, 3–4 mm. longae, pallide virides vel glaucae, raro purpureo-suffusae ; callus minutissimus, obscure scaberulus. *Glumae* minutae, obtusae vel plus minusve truncatae, enerves, scaberulae ; inferior usque ad 0·4 mm. longa ; superior usque ad 0·6 mm. longa. *Anthoecium inferum* sterile : lemma scaberulum, membranaceum, tenuiter 5-nerve ; palea nulla. *Anthoecium superum* ♀ : lemma ut in anthoecio infero, nisi acuminatum et inferne glabrum ; palea lemmati fere aequilonga, hyalina, anguste truncata, 2-nervis ; antherae 1·2 mm. longae.

Uganda : Mt. Elgon, Simu Valley, in shallow soil overlying rocks, 1500 m., *Snowden* 1243 ; Karamoja, Moroto Mtn., *Liebenberg* 10 A ; between Kotido and Koputh, 1200 m., *Liebenberg* 43.

Kenya Colony : Nakuru, *Hitchcock* 25117 (type), *Scott Elliot* 6831.

Southern Rhodesia : Salisbury, forest margin, 1140 m., *Eyles* 3423.

Vern. name :—*Nabijinerwa* (Lugishu, Uganda).

Pennisetum (§ *Gymnothrix*) **massaicum** *Stapf*, descr. emend. ; affine *P. Meziano* Leeke, sed spica spuria longiore laxiore et rhachi angulata denudata fulcris involucrorum laxe obsita, spiculis longioribus differt.

Gramen perenne ; rhizoma breve, cataphyllis late ovatis coriaceis glabris obtectum. *Culmi* erecti vel geniculato-ascendentes, usque ad 45 cm. (vel ultra) alti, graciles, compressi, inferne duri, nodis usque ad 8, e nodis inferioribus et mediis ramosi, spicam spuriam versus scaberuli, ceterum glabri laevesque. *Foliorum* vaginae internodiis plerumque breviores, compressae, carinatae, tenuiter striatae, marginibus ciliatae, nonnunquam pilis e tuberculis ortis sparse hirsutae, sed plerumque glabrae, superiores minute scaberulae, ceterum laeves ; ligulae ad seriem ciliorum densorum redactae ; laminae lineares, tenuiter acutae, usque ad 22 cm. longae, ad 2–4·5 mm. latae, planae vel conduplicatae, firmae, virides vel glaucae, glabrae, raro pilis paucis e tuberculis ortis laxe aspersae, scaberulae vel laeves. *Spica spuria* densa, cylindrica, pallida vel purpureotincta, 2·5–10 cm. longa, 4–10 mm. lata (setis exclusis) ; rhachis gracilis, angulata, scaberula, denudata fulcris minutis hispidulis involucrorum laxe obsita ; involucra subsessilia, demum patentia ; setae complures, gracillimae, ad basin liberae, flexuosae, scaberulae vel interiores basin versus sparse ciliatae, 2–8 ceteris validiores et usque ad 1 cm. longae, ceterae breviores. *Spiculae* solitariae, sessiles, lanceolatae vel anguste ovatae, acute acuminatae, 5–5·5 mm. longae, glabrae. *Glumae* tenuiter membranaceae ; inferior ovata, acuta, 2·5–3 mm. longa, plerumque 1–nervis, raro 3-nervis, supra mediam minute asperula ; superior elliptico-ovata vel late elliptica, acuta, nonnunquam mucronulata, 3·5–4 mm. longa, 5–6-nervis, nervis minute scaberulis. *Anthoecium inferum* ♂ : lemma explanatum late elliptico-ovatum, acute acuminatum, spiculae aequilongum, tenuiter membranaceum, 5-nerve, sursum versus asperulum ; palea lineari-lanceolata, obtusa, lemmati aequilonga, carinis scaberulis. *Anthoecium superum* ♀ : lemma ut in anthoecio infero, nisi ellipticum, mucronatum, firme membranaceum, marginibus hyalinis ; palea lemmati fere aequilonga. *Lodiculae* nullae. *Antherae* 2–2·5 mm. longae, apicibus glabris. *Styli* liberi.

Kenya Colony : Makindu, *Linton* 72 (type) ; Kiu, *Linton* 39 ; Northern Frontier, Isiolo, 1110 m., *Edwards* 1655, 1656.

Tanganyika Territory : Sino, Rift Valley, 900 m., *Haarer* 14A.

The accession of material of this and allied species from East Africa has led to a revision of the specimens originally referred to *P. massaicum*. This has necessitated the present emendation of the description published in the *Kew Bulletin*, 1906, p. 82 and the exclusion of *Scott Elliot* 9292, *Kässner* 584 and *Johnson* from Baringo, which represent *P. Mezianum* Leeke. Linton's specimen no. 72 has at the same time been selected as the name-type.

Pennisetum (§ *Gymnothrix*) **Haareri** *Stapf et C. E. Hubbard*, sp. nov. ; affine *P. giganteo* A. Rich., sed ligula ciliolata, setis minus

inaequalibus, spiculis densioribus demum reflexis distinguendum.

Gramen perenne, laxe caespitosum. *Culmi* erecti, plus minusve 2 m. alti, validi, teretes, nodis usque ad 12, simplices vel e nodis superioribus ramosi, ad spicam spuriam et ad nodos scaberuli et saepe hirsuti, ceterum glabri laevesque. *Foliorum* vaginae internodiis longiores, teretes, tenuiter striatae, inferiores latae, apicem versus pilis brevibus e tuberculis ortis plus minusve hispidae vel glabrescentes, superiores ad margines ciliatae vel glabrae laevesque; ligulae ad seriem ciliorum minutorum redactae; laminae lineares, tenuiter acutae, usque ad 75 cm. longae et ad 10 mm. latae, planae, firmae, virides, post ligulam pilosae, alioqui glabrae vel supra pilis paucis instructae, scaberulae, costa media lata. *Spica spuria* densa, cylindrica, 28–32 cm. longa, 10–12 mm. lata (setis exclusis), pallide viridis et purpureo-suffusa; rhachis dense et minute pubescens, denudata fulcris minutis hispidulis involucrorum dense obsita; involucra sessilia, demum patentia vel deflexa; setae 15–50, gracillimae, ad basin liberae, scaberulae, inaequilongae, terminalis ceteris validior et usque ad 1·4 cm. longa, ceterae usque ad 8 mm. longae. *Spiculae* sessiles, solitariae, lanceolatae, acutae, 4–5 mm. longae, glabrae. *Gluma* inferior oblata vel ovata, obtusa vel acuta, 0·5–1 mm. longa, hyalina, enervis; superior ovata, acuta vel acuminata, nonnunquam mucronata, 1–3 mm. longa, tenuiter membranacea, 1–3-nervis. *Anthoecium inferum* sterile: lemma explanatum ovatum vel elliptico-ovatum, acutum, spiculae fere aequilongum, membranaceum, 5–7-nerve, supra medium minute asperulum; palea linearis, 2 mm. longa, vel nulla. *Anthoecium superum* ♀: lemma explanatum ellipticum, acutum, spiculae aequilongum, membranaceum, 5-nerve, supra medium minute asperulum; palea lanceolata, lemmati fere aequilonga. *Lodiculae* minutae. *Antherae* 2–2·5 mm. longae, apicibus glabris. *Styli* connati vel ad medium liberi.

Tanganyika Territory: Bukoba, 1170 m., *Haarer* 2506.

Pennisetum (§ *Gymnothrix*) **Gossweileri** *Stapf et C. E. Hubbard*, sp. nov.; affine *P. giganteo* A. Rich., sed culmis geniculatis, nodis superioribus barbatis, rhachi laxe pubescente, spiculis inferioribus fasciculatis differt.

Gramen perenne, caespitosum. *Culmi* geniculati, plus 1 m. alti, graciliusculi, compressi, 4- vel pluri-nodes, ramosi, spicam spuriam versus scaberuli, ad nodos superiores barbati, ceterum glabri laevesque. *Foliorum* vaginae internodiis breviores, laxae, laminam versus carinatae, marginibus prope os barbatum ciliatae, sparse hirsutae, demum glabrae laevesque; ligulae ad seriem ciliorum densorum redactae; laminae lineari-lanceolatae, basi abrupte contractae vel leviter angustatae, tenuiter acutae, usque ad 30 cm. longae et ad 12 mm. latae, planae, firmae, glabrae vel supra scaberulae et pilis paucis brevibus pilosae, subtus laeves, marginibus scabridis. *Spica spuria* cylindrica, basi leviter interrupta, ceterum densa, 18 cm.

longa, 11–12 mm. lata (setis exclusis), pallida ; rhachis laxe pubescens, tenuiter costata, denudata fulcris minutis involucrorum laxe obsita ; involucra sessilia, patentia ; setae usque ad 30, gracillimae, inaequales, scaberulae vel plerumque nonnullae interiores basin versus sparse ciliatae, terminalis ceteris validior et usque ad 16 mm. longa, ceterae usque ad 9 mm. longae. *Spiculae* solitariae vel inferiores 2–3-fasciculatae, subsessiles, lanceolatae vel lanceolato-oblongae, acutae, 4·5–5 mm. longae, glabrae. *Glumae* ovatae ; inferior obtusa vel acuta, 1–1·5 mm. longa, hyalina, enervis ; superior acuta, nonnunquam mucronata, 2·5–3 mm. longa, tenuiter membranacea, 1–3-nervis. *Anthoecium inferum* ♂ : lemma explanatum ovato-oblongum, obtusum, mucronulatum, spicula paullo brevius, membranaceum, 5–7-nerve, ad nervos apicem versus scaberulum ; palea lanceolata, lemmate paullo longior, carinis minute scaberulis. *Anthoecium superum* ♀, lanceolatum, acutum : lemma explanatum ovato-oblongum, obtusum, mucronulatum, spiculae aequilongum, membranaceum, 5–7-nerve ; palea lanceolata. *Lodiculae* minutissimae. *Antherae* 2·5–3 mm. longae, apicibus glabris. *Styli* connati.

Portuguese Mayombe : Chiluango, Mimheje River, common, *Gossweiler* 5896.

Pennisetum (§ *Gymnothrix*) **macropogon** *Stapf et C. E. Hubbard*, sp. nov. ; affine *P. natalensi* Stapf, sed laminis pone ligulam dense barbatis, spica spuria atropurpurea, gluma superiore majore 1–3-nervi mucronata differt.

Gramen perenne, rhizomate brevi valido ; innovationes extravaginales. *Culmi* erecti vel ascendentes, usque ad 1·2 m. alti, subvalidi, teretes, simplices vel superne ramosi, nodis usque ad 13, flavidi, purpurei vel virides, infra spicam spuriam tenuiter striati et asperuli, ceterum laeves glabrique. *Foliorum* vaginae internodiis longiores, teretes, striatae, glabrae laevesque, inferiores latae, laxae, superiores arcte appressae ; ligulae ad seriem ciliorum redactae ; laminae lineares, basi angustatae, tenuiter acutae, usque ad 25 cm. longae, 2·5–3 mm. latae, planae, firmae, subtus virides et laeves, supra glaucescentes, arcte nervosae et scaberulae, ligulam versus pilis longis sericeis dense barbatae, ceterum glabrae. *Spica spuria* densa, cylindrica, erecta, gracilis vel validiuscula, 7–22 cm. longa, 4–7 mm. lata (setis exclusis), atropurpurea ; rhachis striata, scaberula, denudata fulcris minutissimis involucrorum densiuscule obsita ; involucra subsessilia, patentia ; setae usque ad 36, scaberulae, inaequales, terminalis ceteris validior et usque ad 8 mm. longa, ceterae usque ad 5 mm. longae. *Spiculae* solitariae, sessiles, ovatae vel ovato-oblongae, 3–3·5 mm. longae, glabrae. *Gluma* inferior ovata, obtusa, usque ad 1 mm. longa, tenuiter membranacea, uninervis vel enervis ; gluma superior ovata vel ovato-oblonga, obtusa vel acuta, mucronata, 1·5–2·4 mm. longa, membranacea, 1–3-nervis. *Anthoecium inferum* ♂ : lemma explanatum late ovato- vel elliptico-oblongum, obtusum, breviter

mucronatum, spiculae aequilongum, membranaceum, 5-nerve; palea elliptica, bifida, lemmati fere aequilonga, carinis tenuiter scaberulis. *Anthoecium superum* ♀, anguste ovatum, acutum: lemma explanatum ellipticum, obtusum, mucronatum, spiculae aequilongum, firme membranaceum, 5-nerve; palea anguste ovata, truncata, lemmati aequilonga. *Lodiculae* minutae. *Antherae* 1·5–2 mm. longae, apicibus glabris. *Styli* connati.

Southern Rhodesia: Salisbury, Makabusi River, amongst rocks, 1440 m., *Eyles* 3083; on river bank, *Eyles* 4771 (type); Inyazura, sand veld, *Fitt* 150; Gazaland, Nyahodi River, 1200 m., *Swynnerton* 1664A.

Pennisetum (§ *Gymnothrix*) **glaucocladum** *Stapf et C. E. Hubbard*, sp. nov.; affine *P. macropogoni* Stapf et C. E. Hubbard, sed laminis foliorum ebarbatis, culmis glaucis et pruinosis, anthoecio infero sterili differt.

Gramen perenne; rhizomata valida, usque ad 60 cm. longa et 8 mm. lata, multinodia, glabra laeviaque; innovationes extravaginales. *Culmi* erecti, usque ad 2·3 m. alti, validi, usque ad 8 mm. lati, teretes, simplices, raro ramosi, nodis usque ad 10, infra spicam spuriam dense scaberuli vel hispiduli, ceterum glabri laevesque; internodia inferiora omnino pruinosa vel ut superiora tantum infra nodos pruinosa vel glaucescentia. *Foliorum* vaginae internodiis longiores, laxae, teretes, glabrae laevesque, superne striatae et saepe transverse nervosae, inferiores latae, pallidae vel subfuscae, superiores virides; ligulae ad seriem ciliorum densorum redactae; laminae lineares, acutae, usque ad 45 cm. longae et ad 7 mm. latae, planae vel convolutae, firmae, virides, pone ligulam pilosae, marginibus scaberulis, ceterum glabrae laevesque. *Spica spuria* densissima, cylindrica, 7·5–19 cm. longa, 6–8 mm. lata (setis exclusis), pallida vel purpurea; rhachis gracilis, hispidula, denudata fulcris minutis involucrorum dense obsita; involucra sessilia, patentia; setae 12–20, gracillimae, scaberulae, inaequales, terminalis ceteris paulo validior et usque ad 8 mm. longa, ceterae usque ad 5 mm. longae. *Spiculae* solitariae, sessiles, lanceolatae, ovatae vel oblongae, acutae, 3–3·5 mm. longae, glabrae. *Glumae* hyalinae; inferior oblata, truncata, 0·3–0·5 mm. longa, enervis; superior oblata vel late ovata, obtusa vel acuta et mucronulata, 0·3–1 mm. longa, enervis vel uninervis. *Anthoecium inferum* sterile: lemma explanatum late ovatum vel ovato-oblongum, acutum vel obtusum, mucronulatum, 2·5–3 mm. longum, 3–5-nerve, membranaceum, superne minute scaberulum; palea nulla. *Anthoecium superum* ♀, lanceolatum vel oblongum, acutum: lemma explanatum late ovato- vel elliptico-oblongum, obtusum, mucronulatum, spiculae aequilongum, 5-nerve, superne minute scaberulum; palea lanceolata, lemmate paulo brevior. *Lodiculae* minutissimae. *Antherae* fere 2 mm. longae, apicibus glabris. *Styli* connati. *Caryopsis* late oblonga, dorso compressa, 1 mm. longa.

Northern Rhodesia: Livingstone, *Rogers* 7080.

Southern Rhodesia : Salisbury, 1440 m., *Brain* 4175, *Fitt* 152 ; Hopley Farm, 1500 m., *Eyles* 1618 ; Hunyani River, lining river bank, 1410 m., *Eyles* 4903 (type) ; Norton, 1350 m., *Eyles* 3458 ; Umtali, 990 m., *Eyles* 3073 ; Marandellas, 1560 m., *Walters in S. Rhod. Govt. Herb.* 2240 ; Ruzawi, in vlei, 1590 m., *Eyles* 4021 ; Matabeleland, Matopo Hills, *Rogers* 7951.

Pennisetum (§ *Gymnothrix*) **Franchetianum** *Stapf et C. E. Hubbard*, sp. nov. ; affine *P. stenorrhachi* Stapf et C. E. Hubbard (*P. tenue* Mez, non Fig. et De Not.), sed culmis simplicibus paucinodibus laevibus, fulcris involucrorum ad cicatrices subpatelliformes redactis, seta terminali longiore, gluma superiore emucronata differt.

Gramen perenne (?) ; basis ignota. *Culmi* graciles, ultra 30 cm. alti, geniculati, teretes, simplices, paucinodes, glabri laevesque. *Foliorum* vaginae internodiis longiores, laxae, teretes, laeves, glabrae vel ore pilis paucis praeditae ; ligulae ad seriem ciliorum redactae, pilis minutissimis ; laminae lineares, tenuiter acutae, usque ad 22 cm. longae, 2·5–4·5 mm. latae, planae, firmae, laeves vel ad margines et supra apicem versus scaberulae, pone ligulam obscure pilosae, ceterum glabrae. *Spica spuria* densa, cylindrica, 9 cm. longa, 5–6 mm. lata (setis exclusis), purpureo-tincta ; rhachis gracilis, tenuiter sulcata et angulata, scaberula, denudata cicatricibus subpatelliformibus minutissimis involucrorum densiuscule obsita ; involucra sessilia, patentia ; setae c. 20, gracillimae, scaberulae, inaequales, terminalis usque ad 8–16 mm. longa et ceteris validior, ceterae usque ad 5 mm. longae. *Spiculae* solitariae, sessiles, oblongae vel lanceolato-oblongae, 3·6–4 mm. longae, glabrae. *Glumae* ovatae, acutae vel obtusae, tenuiter membranaceae ; inferior 0·5–0·6 mm. longa, enervis vel uninervis ; superior 2–2·4 mm. longa, 1–3-nervis. *Anthoecium inferum* sterile : lemma explanatum ovato-ellipticum, abrupte acutum vel obtusum, mucronatum, spiculae aequilongum vel plerumque paulo brevius, membranaceum, 5-nerve ; palea nulla vel minutissima. *Anthoecium superum* ♂ : lemma explanatum elliptico-ovatum, obtusum, mucronatum, spiculae aequilongum, membranaceum, 5-nerve ; palea lemmate brevior, lineari-lanceolata, minute truncata, carinis superne scaberulis. *Lodiculae* minutissimae. *Antherae* 2 mm. longae, apicibus glabris. *Styli* connati.

Gaboon : without precise locality, *Leroy* (type in Herb. Mus. Paris).

P. exile Stapf et C. E. Hubbard, to which the above species is closely allied, may be distinguished by the many-noded culms, minute yet prominent puberulous-tipped stumps of the fallen involucres and the slightly smaller spikelets. *P. riparioides* Hochst., with which our new species was confused by Franchet (Contrib. Fl. Congo Franç. 52), has branched culms scaberulous below the looser panicle, minute projecting stumps of the fallen involucres and slightly larger spikelets.

Pennisetum (§ *Gymnothrix*) **exile** *Stapf et C. E. Hubbard*, sp. nov. ; affine *P. stenorrhachi* Stapf et C. E. Hubbard, sed setis paucis,

gluma inferiore ovata acuta enervi, anthoecio infero sterili ad lemma redacto differt.

Gramen perenne, rhizomate gracili erecto nudo. *Culmi* erecti, circiter 60 cm. alti, graciles, teretes, paulo ramosi, nodis usque ad 8, glabri laevesque. *Foliorum* vaginae teretes, fere glabrae, laeves, inferiores internodiis longiores, superiores breviores ; ligulae ad seriem ciliorum redactae ; laminae lineares, acutae, usque ad 13 cm. longae et 4 mm. latae, convolutae, erectae, rigidiusculae, glabrae, supra asperulae, subtus laeves. *Spica spuria* cylindrica, sublaxa, erecta, 10 cm. longa, 5 mm. lata (setis exclusis), pallide viridis et purpureo-variegata ; rhachis tenuiter costata, scaberula, denudata fulcris minutis involucrorum laxe obsita ; involucra sessilia, paulo patentia ; setae circiter 15, gracillimae, flexuosae, scaberulae, inaequales, terminalis ceteris validior et usque ad 11 mm. longa, ceterae breviores. *Spiculae* solitariae, sessiles, lanceolatae, dorso acute acuminatae, plerumque hiantes, 3·5 mm. longae, glabrae. *Glumae* ovatae, tenuiter membranaceae ; inferior obtusa, circiter 0·6 mm. longa, enervis ; superior acuta, 1·2 mm. longa, enervis vel uninervis. *Anthoecium inferum* sterile, ad lemma redactum : lemma explanatum ovatum vel ovato-oblongum, acutum, spicula paulo brevius, membranaceum, 5-nerve ; palea nulla. *Anthoecium superum* ♀ : lemma ut in anthoecio infero, sed paulo latius et spiculae aequilongum ; palea anguste ovata, truncata, lemmate paulo brevior. *Lodiculae* minutae. *Styli* connati.

Tanganyika Territory : Kyimbila District ; Musomboland, Bundali Mts., *Stolz* 1294.

Pennisetum (§ *Gymnothrix*) **Davyi** *Stapf et C. E. Hubbard*, sp. nov., affine *P. Quartiniano* A. Rich., sed spiculis majoribus, lemmate inferiore aristato-acuminato, seta terminali usque ad 2·8 cm. longa, culmis 2-nodibus differt.

Gramen perenne, e rhizomate brevi ortum. *Culmi* suberecti, usque ad 60 cm. longi, teretes, moderate graciles, simplices vel basi ramosi, 2-nodes, infra spicam spuriam leviter scaberuli, ceterum glabri laevesque. *Foliorum* vaginae internodiis plerumque breviores, laxiusculae, teretes, tenuiter striatae, glabrae laevesque ; ligulae ad seriem ciliorum redactae ; laminae lineares, in apicem obtusum attenuatae, usque ad 25 cm. longae, plerumque convolutae vel explanatae et usque ad 5 mm. latae, firmae, rigidiusculae, glabrae laevesque, supra albidae. *Spica spuria* cylindrica, densiuscula, plumosa, 10–12·5 cm. longa, 5 mm. lata (setis exclusis), purpurea ; rhachis gracilis, scaberula, denudata fulcris minutis scaberulis involucrorum sublaxe obsita ; involucra sessilia ; setae circiter 12, gracillimae, scaberulae, purpureae, inaequales, terminalis ceteris validior et usque ad 2·8 cm. longa, ceterae breviores usque ad 15 mm. longae. *Spiculae* solitariae, subsessiles, lanceolatae, acutae, 4–4·5 mm. longae, glabrae. *Glumae* hyalinae ; inferior oblata, truncata, c. 0·4 mm. longa, enervis ; superior late ovata, obtusa, 1 mm. longa, enervis vel uninervis. *Anthoecium inferum* sterile :

lemma explanatum ellipticum vel elliptico-ovatum, aristato-acuminatum, spiculae aequilongum, membranaceum, 5–nerve ; palea nulla. *Anthoecium superum* ♀, lanceolatum, tenuiter acutum : lemma explanatum elliptico- vel ovato-oblongum, acute acuminatum, spiculae aequilongum, firme membranaceum, 5-nerve ; palea lanceolata, lemmati aequilonga. *Lodiculae* minutae. *Antherae* 2 mm. longae, apicibus glabris. *Styli* ad trientem connati.

NYASALAND : Mt. Mlanje, on rock face in stream bed, 1840 m., *Burtt Davy* 2028–29.

Pennisetum (§ *Gymnothrix*) **Dowsonii** *Stapf et C. E. Hubbard*, sp. nov. ; affine *P. ripario* Hochst., sed anthoecio inferi sterili, lemmate inferiore breviore enervi vel 1–3-nervi, spica spuria densa latiore differt.

Gramen perenne. *Culmi* e basi prostrato ascendentes, e nodis inferioribus radicantes, usque ad 50 cm. alti, graciles vel validiusculi, carnosi, compressi, simplices vel ramosi, 4–7-nodes, infra paniculam scaberuli et pubescentes vel glabri laevesque. *Foliorum* vaginae internodiis plerumque breviores, latae, laxae, compressae, laeves, glabrae vel ore laxe barbatae ; ligulae ad seriem ciliorum minutorum redactae ; laminae lineares, apice subobtusae, usque ad 30 cm. longae et ad 8 mm. latae, planae vel complicatae vel apicem versus involutae, firmae, pone ligulam pilosae, ceterae glabrae, supra scaberulae, subtus laeves. *Spica spuria* erecta, densiuscula, cylindrica, 4·5–10 cm. longa, 8–12 mm. lata (setis exclusis), pallida vel purpurascens ; rhachis angulata, scaberula, hispidula, denudata fulcris basibus minutis involucrorum dense vel laxe obsita ; involucra erecta vel paulo patentia, pedunculis usque ad 0·5 mm. longis ; setae 14–24, gracillimae, scaberulae, inaequales, una vel duae interiorum ceteris validiores et 8–11 mm. longae, ceterae breviores. *Spiculae* solitariae, subsessiles, lanceolatae, acutae, 6–8 mm. longae, glabrae. *Gluma* inferior nulla ; gluma superior oblata vel oblongo-elliptica, obtusa, 1 mm. longa, hyalina, enervis, vel nulla. *Anthoecium inferum* sterile : lemma explanatum lanceolatum vel late ovatum vel ovato-ellipticum, acutum vel obtusum, 1·5–3·5 mm. longum, hyalinum vel tenuiter membranaceum, enerve vel 1–3-nerve ; palea nulla. *Anthoecium superum* ♀, lanceolatum, acutum : lemma explanatum ovatum vel oblongo-ovatum, acutum, spiculae aequilongum, membranaceum, 3–5-nerve, apicem versus asperulum ; palea lanceolata, acuta, lemmati aequilonga. *Lodiculae* nullae. *Antherae* 2·5–3 mm. longae, apicibus glabris. *Styli* connati.

KENYA COLONY : Aberdares Range, plain of Lake Ol'Bolossat, 2100 m., *Dowson* 562 (type) ; Uplands, from the edge of a swamp, 2040 m., *Edwards* 1648 ; cultivated at the Scott Agricultural Laboratories, originally obtained from Uplands, *Edwards* 1680 (in part).

Pennisetum (§ *Gymnothrix*) **salifex** *Stapf et C. E. Hubbard*, sp. nov. ; affine *P. ripario* Hochst., sed spiculis majoribus, lemmati superiore 6–11-nervibus differt.

Gramen perenne, rhizomatibus et stolonibus repentibus multiramosis ; stolones longi, validi, usque ad 7 mm. lati, carnosi, glabri laevesque, multinodes, nodis radicantibus, internodiis 1·3–10 cm. longis. *Culmi* ascendentes, usque ad 30 cm. alti vel 60–90 cm. longi, moderate validi, compressi, simplices vel ramosi, pauci- vel multinodes, glabri laevesque. *Foliorum* vaginae imbricatae vel internodis breviores, breves, latae, compressae, carinatae, ore pilis paucis hirsutae vel glabrae ; ligulae ad seriem ciliorum redactae ; laminae lineares vel lineari-lanceolatae, apice subacutae vel callosae, 4–16 cm. longae, 4–10 mm. latae, planae vel complicatae vel marginibus involutis, firmae, virides vel leviter glaucae, glabrae vel sparse hirsutae, apice scaberulae, subtus laeves. *Spica spuria* laxiuscula vel densa, 2–6·5 cm. longa, 5–15 mm. lata (setis exclusis), pallida vel purpurea, pauci- vel multi-spiculata ; rhachis scaberula, denudata fulcris minutis involucrorum laxe obsita ; involucra subsessilia, basi minute barbata ; setae 20–30, gracillimae, inaequales, 1–3 interiorum ceteris validiores et usque ad 15 mm. longae, ceterae breviores. *Spiculae* solitariae vel binae, subsessiles, lanceolatae, acutae, 8–10·5 mm. longae, glabrae. *Glumae* hyalinae ; inferior oblata, 0·6 mm. longa, enervis, vel nulla ; superior oblata vel ovata vel ovato-oblonga, acuta vel obtusa, 2–3 mm. longa, 1–3-nervis. *Anthoecium inferum* ♂ vel plerumque sterile : lemma explanatum lanceolato- vel ovato-oblongum, acutum, spiculae subaequilongum, arcte 5–9-nerve, membranaceum ; palea oblonga, 7 mm. longa, carinis minute scaberulis, vel nulla. *Anthoecium superum* ♀, lanceolatum, tenuiter acutum vel acuminatum : lemma explanatum lanceolato-ovatum, acutum, spiculae aequilongum, membranaceum, 6–11-nerve ; palea lemmati aequilonga, lanceolata. *Lodiculae* minutae vel nullae. *Antherae* 3–4 mm. longae, apicibus glabris. *Styli* connati.

Uganda : Mt. Elgon ; Bukiga, etc., planted near native houses, 1350–1800 m., *Snowden* 1214 ; Butandiga, in short grass turf following cultivation and by roadsides, 2100 m., *Snowden* 1227 (type).

Kenya Colony : cultivated at the Scott Agricultural Laboratories, originally obtained from Uplands, 2250 m., *Edwards* 1477 ; 1680 (in part).

Tanganyika Territory : Kilimanjaro ; Mashami, Fau, 1500 m., *Haarer* 1007.

Vern. name : *Nabutwa* (Lugishu).

Pennisetum (§ *Gymnothrix*) **grandiflorum** *Stapf et C. E. Hubbard*, sp. nov. ; affine *P. ripario* Hochst., sed spiculis majoribus, culmis validioribus, laminis foliorum longioribus, spica spuria latiore, anthoecio infero sterili differt.

Gramen perenne (?) ; basis ignota. *Culmi* geniculato-ascendentes, usque ad 60 cm. longi, validi, usque ad 7 mm. lati, carnosi, compressi, simplices, plurinodes, infra spicam spuriam scaberuli, ceterum glabri laevesque. *Foliorum* vaginae internodiis longiores, latae,

compressae, laeves, firmae, ore pilis paucis exceptis glabrae; ligulae ad seriem ciliorum densorum redactae; laminae lineares, in apicem obtusum attenuatae, usque ad 33 cm. longae, 5–10 mm. latae, complicatae vel planae, rigidiusculae, supra prominenter nervosae et glabrae vel pilis paucis obsitae, ad apicem scaberulae, ceterum laeves. *Spica spuria* cylindrica, densa, erecta, obtusa, 5-9 cm. longa, 10–18 mm. lata (setis exclusis), purpurea; rhachis subvalida, minute hispidula, scaberula, denudata fulcris minutissimis involucrorum laxe obsita; involucra subsessilia, basi minute barbata; setae 16–25, gracillimae, scaberulae, pallidae vel apicibus purpureis, inaequales, una vel duae interiorum ceteris validiores et usque ad 12–14 mm. longae, ceterae spicula plerumque breviores. *Spiculae* solitariae, raro 2–3-fasciculatae, sessiles, lanceolato-oblongae vel lanceolatae, acutae, 10–12 mm. longae, glabrae. *Gluma* inferior nulla vel minutissima; gluma superior oblata, truncata, 1 mm. longa, hyalina, enervis, vel nulla. *Anthoecium inferum* sterile: lemma explanatum lanceolato-ovatum vel ovatum, acutum, 4·5–6 mm. longum, tenuiter membranaceum, 1–5-nerve (nervis lateralibus brevibus); palea nulla. *Anthoecium superum* ♀, lanceolatum, acutum: lemma explanatum late ovatum vel oblongo-ovatum, acutum, spiculae aequilongum, membranaceum, 7–9-nerve; palea acuta, lemmati aequilonga. *Lodiculae* nullae. *Antherae* 4–5 mm. longae, apicibus glabris. *Styli* connati.

Kenya Colony: Aberdares Range; Lari Swamp, 2250 m., *Battiscombe* 507 (type); Escarpment, *Linton* 183; Makindu, *Linton* 171.

Pennisetum (§ *Gymnothrix*) **catabasis** *Stapf et C. E. Hubbard*, sp. nov.; affine *P. Hohenackeri* Hochst., sed culmis paulo altioribus ramosis, apicibus antherarum acutis penicillatis differt.

Gramen perenne, dense caespitosum. *Culmi* erecti, 90–135 cm. alti, validi, rigidi, compressi, plerumque superne ramosi, ramis erectis nodis usque ad 9 vel pluribus, spicam spuriam versus scaberuli et nonnumquam pubescentes, ceterum glabri laevesque. *Foliorum* vaginae laevissimae, glabrae vel ore plerumque laxe barbatae, inferiores longae, valde compressae, carinatae, imbricatae, flabellatae, latae, pallidae vel suffuscae, coriaceae, superiores angustiores; ligulae ad seriem ciliorum densorum redactae; laminae anguste lineares vel lineares, oblique subacutae, usque ad 45 cm. longae et ad 5 mm. latae, arcte complicatae vel explanatae, rigidiusculae, durae, glaucae vel virides, glabrae, costa media et marginibus apicem versus scaberulae. *Spica spuria* densa, cylindrica, 10–25 cm. longa, 6–11 mm. lata (setis exclusis), pallide viridis vel purpureo-tincta; rhachis angulata, scaberula, denudata fulcris minutis subcupuliformibus involucrorum laxe obsita; involucra erecta vel leviter patentia, pedunculis minutis; setae 12–20, gracillimae, scaberulae, inaequales, terminalis ceteris validior et usque ad 2 cm. longa, ceterae breviores. *Spiculae* solitariae, sessiles, lanceolatae, acutae, 6·5–9 mm. longae, glabrae. *Gluma* inferior oblata, ovata vel

oblonga, obtusa vel acuta, 0·5–2·5 mm. longa, hyalina, enervis vel uninervis ; gluma superior anguste ovata vel elliptica, obtusa, 3–4·5 mm. longa, tenuiter membranacea, 1–3-nervis. *Anthoecium inferum* sterile : lemma explanatum oblongum vel late ovato-oblongum, obtusum, spiculae aequilongum, firme membranaceum, 7–11-nerve ; palea usque ad 1·5 mm. longa, vel nulla. *Anthoecium superum* ♀, lanceolatum, acutum : lemma explanatum oblongum vel ovato-oblongum, subacutum vel obtusum, spiculae aequilongum, firme membranaceum, 5–7-nerve ; palea lanceolata, acuta, lemmate paulo brevior. *Lodiculae* minutae. *Antherae* 4–5 mm. longae, apicibus acutis penicillatis. *Styli* connati vel apicem versus liberi.

Uganda : on the banks of Asua River, between Lira and Kitgum, 1020 m., *Liebenberg* 26.

Kenya Colony : near Forest Station, in tussock grassland, 2290 m., *Fries* 655 ; Nakuru, 1890 m., *Taylor* 1296 (type) ; in the low land near a lake, *Hitchcock* 25096 ; Kinangop, in shallow black soil, 2100 m., *Edwards* 1457, *Turner* 1574A ; Gilgil River, 2100 m., *Dowson, Scott Elliot* 6662 ; Nairobi, cultivated, *Lyne Watt* 12, *McDonald* 931 ; between Nairobi and Nanyuki, in grassland, *Hitchcock* 24750 ; Kabete, 1860 m., *Walker* 35 ; Sotik, common tussock-grass in patches in park country, 1800 m., *McDonald* 1081.

Vern. name : *Kikutu* (Kikuyu).

Pennisetum atrichum (§ *Brevivalvula*) *Stapf et C. E. Hubbard*, sp. nov. ; affine *P. polystachyo* Schult., sed setis glabris vel fere glabris differt.

Gramen perenne ; innovationes extravaginales. *Culmi* erecti vel leviter geniculati, usque ad 1·8 m. alti, validi, teretes, e nodis superioribus ramosi, nodis usque ad 8, spicam spuriam versus scaberuli, ceterum glabri laevesque. *Foliorum* vaginae internodiis breviores, laxae, laminam versus carinatae, striatae, laeves, glabrae vel marginibus ciliatae et ore laxe barbatae ; ligulae brevissimae, truncatae, ciliatae ; laminae lineares, basi angustatae, acutae, usque ad 45 cm. longae, 4–16 mm. latae, planae, firmae, virides, supra pilis brevibus e tuberculis ortis laxe hirsutae vel glabrae, scaberulae. *Spica spuria* densa, cylindrica, flexuosa vel stricta, 12–20 cm. longa, 6–8 mm. lata (setis exclusis), purpurea, purpurascenti-fusca vel aureo-fusca ; rhachis angulata, angulis minute scaberula ; involucra subsessilia, decidua, demum patentia vel deflexa, basi minute barbata ; setae usque ad 25, gracillimae, scaberulae, raro pilis brevibus paucis praeditae, inaequales, terminalis ceteris validior et usque ad 2·6 cm. longa, ceterae usque ad 12 mm. longae. *Spiculae* solitariae, sessiles, lanceolato-oblongae, 3·5–4·5 mm. longae, glabrae, pallide fuscae. *Gluma* inferior lanceolata, obtusa vel acuta, usque ad 1·5 mm. longa, hyalina, enervis vel uninervis, vel nulla ; gluma superior explanata ovato-oblonga, abrupte acuta, spiculae aequilonga, tenuiter membranacea, 5–7 (raro 9)-nervis, superne minute puberula. *Anthoecium inferum* ♂ : lemma explanatum late oblongum, 3–3·5 mm. longum, breviter 3-lobum, lobis obtusis vel

acutis aequalibus vel lobo medio longiore, tenuiter membranaceum, 5–7-nerve, supra medium minute puberulum ; palea linearis, lemmati subaequilonga, carinis sparse ciliolatis vel scabridis. *Anthoecium superum* ♀, lanceolatum, obtusum : lemma explanatum late ovatum, truncatum, 2–2·5 mm. longum, chartaceum, laeve, nitens, obscure 5-nerve, apice ciliolatum ; palea lemmati aequilonga, chartacea. *Lodiculae* nullae. *Antherae* 2 mm. longae, apicibus glabris. *Styli* liberi.

French Guinea : Timbo, *Pobeguin* 1761 (in part).

Northern Nigeria : Borgu, Fakun, *Barter* 842 ; Naraguta, near water, *Lely* 439.

Kenya Colony : 20 miles north of Mombasa, in moist sandy soils, *Grant* 878.

Belgian Congo : Bas Congo ; Thysville, *Vanderyst* 4469, 4473 ; Mombuttu, Kussumbo, *Schweinfurth* 3615 ; Upper Luapula, Tschinsenda, *Rogers* 10396a ; Sakenia, *Mundy in S. Rhod. Govt. Herb.* 5036.

Nyasaland : Zomba, 1170 m., *Manning* 4 (type).

Northern Rhodesia : near Mumbwa, *Macaulay* 26.

Pennisetum (§ *Penicillaria*) **darfuricum** *Stapf et C. E. Hubbard*, sp. nov. ; affine *P. fallaci* Stapf et C. E. Hubbard, sed spiculis majoribus, setis interioribus involucrorum longioribus plumosis differt.

Gramen annuum. *Culmi* validi, subalti, ramosi, in latere ad ramum spectante canaliculati vel applanati, infra spicam spuriam dense pubescentes, ceterum glabri laevesque. *Foliorum* vaginae internodiis demum breviores, striatae, glabrae laevesque ; ligulae ad seriem ciliorum densorum redactae ; laminae lineares, usque ad 30 cm. (vel ultra) longae, 12–24 mm. latae, planae, pilis e tuberculis ortis sparse hirsutae, costa media valida, marginibus scabridis. *Spica spuria* cylindrica, subdensa, c. 15 cm. longa et 18 mm. lata (setis exclusis), pallida ; rhachis dense pubescens, gracilis, denudata fulcris minutis involucrorum laxiuscule obsita ; involucra sessilia, demum patentia ; setae 70–90, gracillimae, exteriores inaequales, breviores, scaberulae, interiores (25–35) praeter apices spiculam superantes scaberulos pilis e tuberculis ortis dense sericeo-plumosae, terminalis ceteris validior et usque ad 20 mm. longa, ceterae subaequales usque ad 12 mm. longae. *Spiculae* solitariae, pedicellatae, pedicellis usque ad 1 mm. longis, lanceolatae vel lanceolato-oblongae, leviter gibbosae, 7–8 mm. longae, glabrae. *Glumae* latissimae, truncatae, hyalinae, enerves ; inferior saepe nulla ; superior usque ad 0·6 mm. longa. *Anthoecium inferum* ♂ : lemma explanatum lanceolato-oblongum, obtusum, mucronatum, spiculae aequilongum, membranaceum, 3–4-nerve ; palea lanceolata, minute truncata, lemmati aequilonga, dorso minute scaberula. *Anthoecium superum* ♀ : lemma explanatum ovatum, acutum, spiculae aequilongum vel plerumque paulo brevius, tenuiter chartaceum, 5–7-nerve, prope margines scaberulum, dorso infra apicem prominenter

nervosum laeve ; palea lemmate paulo brevior, palea ei anthoecii inferioris similis sed firmior et carinis leviter scaberulis exceptis dorso laevis. *Lodiculae* nullae. *Antherae* 4 mm. longae, apicibus penicillatis. *Styli* connati.

SUDAN : Darfur ; Meidob, in clay valley below Jebel Kaboija, in damp ground by water courses, *Michelmore* !

Vern. name : *Wiwi* (Arabic).

Pennisetum (§ *Penicillaria*) **ochrops** *Stapf et C. E. Hubbard*, sp. nov. ; affine *P. fallaci* Stapf et C. E. Hubbard, sed setis interioribus involucrorum subaequalibus, lemmate inferiore elliptico-oblongo late emarginato vel truncato, lemmate superiore late ovato obtusissimo marginibus ciliolatis differt.

Gramen annuum. *Culmi* erecti, validi, usque ad 150 cm. alti, teretes vel in latere ad ramum spectante canaliculati, e nodis plurimis ramosi, nodis superioribus barbatis, spicam spuriam versus dense pubescentes, ceterum glabri laevesque. *Foliorum* vaginae internodiis breviores, apicem versus ciliatae vel glabrae, laeves ; ligulae ad seriem ciliorum redactae, pilis densis usque ad 3 mm. longis ; laminae lineares, basi abrupte contractae, tenuiter acutae, usque ad 60 cm. longae, 8–20 mm. latae, planae, firmae, glaucae, glabrae, marginibus fere laevibus. *Spica spuria* cylindrica, densissima, 7·5–10 cm. longa, 12 mm. lata (setis exclusis), pallida ; rhachis gracilis, dense pubescens, denudata fulcris minutis involucrorum dense obsita ; involucra sessilia, demum patentia vel deflexa ; setae usque ad 80, gracillimae, exteriores valde inaequales, breviores, scaberulae, interiores (8) praeter apices spiculam superantes scaberulos pilis e tuberculis ortis ciliatae, subaequales, usque ad 9 mm. longae. *Spiculae* solitariae, minute pedicellatae, lanceolato-oblongae, leviter gibbosae, 4·5–5·5 mm. longae, fere glabrae. *Glumae* latissimae, truncatae vel rotundatae, hyalinae, enerves, usque ad 0·4 mm. longae, vel inferior nulla. *Anthoecium inferum* ♂ vel ad lemma redactum : lemma explanatum elliptico-oblongum, late emarginatum vel truncatum, spicula paulo brevius, mucronulatum, membranaceum, apice ciliolatum, 3–5-nerve, vel tenuissimum, 1–3-nerve et ad modum redactum; palea lineari-lanceolata, minute truncata, lemmati fere aequilonga, carinis scaberulis, vel nulla. *Anthoecium superum* ♀ : lemma explanatum late ovatum, obtusissimum, palea leviter brevius, mucronatum, tenuiter coriaceum, 5–7-nerve, dorso infra apicem minute scaberulum prominenter nervosum laeve et nitens, marginibus ciliolatis ; palea lanceolata, minute truncata, spiculam aequans. *Lodiculae* nullae. *Antherae* 3 mm. longae, apicibus penicillatis. *Styli* connati. *Caryopsis* oblonga, dorso compressa, 2 mm. longa.

NORTHERN NIGERIA : near Lake Chad, very common on sandy soil near Kukawa, also between Kauwa and Baga Seyoram, in patches between Gumnari and Bodoweri and between Kalkala and Marte, *Golding* 22.

Pennisetum (§ *Penicillaria*) **Rogeri** *Stapf et C. E. Hubbard*, sp. nov. ; affine *P. mollissimo* Hochst., sed setis involucrorum rigidis crassioribus longioribus (usque ad 24 mm. longis), spiculis paulo majoribus, lemmate inferiore obtusissimo 3–5-nervi, lemmate superiore lanceolato-oblongo prope margines scaberulo differt.

Gramen annuum. *Culmi* erecti vel ascendentes, subalti, ramosi, nodis superioribus barbati, spicam spuriam versus dense pubescentes, ceterum glabri laevesque. *Foliorum* vaginae internodiis breviores, laminam versus scaberulae vel laeves, glabrae vel superne prope margines ciliatos pilis paucis e tuberculis ortis hirsutae ; ligulae ad seriem ciliorum redactae, pilis densis usque ad 3 mm. longis ; laminae lineares, basi contractae vel rotundatae, tenuiter acutae, usque ad 30 cm. longae, 8–12 mm. latae, planae, pilis brevibus e tuberculis ortis sparse hirsutae vel glabrescentes, supra scaberulae, marginibus cartilagineis scabridis. *Spica spuria* densa, cylindrica, setigera, flexuosa, 10–15 cm. longa, 12–18 mm. lata (setis exclusis), straminea vel fusca ; rhachis moderate gracilis, villosula, denudata fulcris minutissimis involucrorum subdense obsita ; involucra subsessilia, demum patentia ; setae usque ad 80, graciles, rigidulae, inaequales, exteriores breviores et scaberulae, interiores (25–30) pilis longis albis e tuberculis ortis dense plumosae praeter apices spiculam superantes scaberulos, terminalis ceteris validior et usque ad 24 mm. longa, ceterae subaequales usque ad 6 mm. longae. *Spiculae* solitariae vel binae, pedicellatae, pedicellis usque ad 1·5 mm. longis, lanceolatae vel anguste oblongae, leviter gibbosae, 6·5–7 mm. longae. *Glumae* latissimae, truncatae vel obtusissimae, usque ad 0·6 mm. longae, hyalinae, enerves, ciliolatae, vel inferior nulla. *Anthoecium inferum* ♂, raro ♀ : lemma explanatum lanceolato-oblongum, obtusissimum, spiculae aequilongum, mucronatum, firme membranaceum, 3–5-nerve, apicem versus minute scaberulum ; palea lanceolata, lemmate paulo brevior, minute scaberula. *Anthoecium superum* ♀ : lemma explanatum lanceolato-oblongum, obtusum, spiculae subaequilongum, mucronatum, tenuiter coriaceum, 5–7-nerve, prope margines supra medium scaberulum vel raro minute puberulum ; palea lanceolata, minute truncata, lemmati subaequilonga. *Lodiculae* nullae. *Antherae* 4 mm. longae, apicibus penicillatis. *Caryopsis* oblonga, 2·5 mm. longa.

Senegal : without precise locality, in old cultivations and near habitations, *Roger* (type) ; Longa, in cultivated fields, *Chevalier* 33824.

Pennisetum (§ *Penicillaria*) **Chevalieri** *Stapf et C. E. Hubbard*, sp. nov. ; affine *P. fallaci* Stapf et C. E. Hubbard, sed spica spuria validiore, setis terminalibus longioribus interioribus minus hirsutis, lemmate superiore ciliolato differt.

Gramen annuum (?) ; basis ignota. *Culmi* erecti, subvalidi, ramosi, in latere ad ramum spectante canaliculati, plurinodes, spicam spuriam versus dense pubescentes et infra nodos dense seriatim

albo-pilosos leviter pubescentes. *Foliorum* vaginae teretes, internodiis breviores, superne pilis rigidis patentibus e tuberculis ortis laxe hirsutae vel plus minusve glabrescentes vel glabrae, sed plerumque ad summum dorsum dense barbatae ; laminae lineares, basi paulo contractae, usque ad 45 cm. (vel ultra) longae et ad 2 cm. latae, planae, firmae, virides, pilis brevibus e tuberculis ortis laxe hirsutae, marginibus cartilagineis scabridis, costa media valida. *Spica spuria* densa, cylindrica, 15 cm. longa, 14 mm. lata (setis exclusis), flavido-fusca, setosa ; rhachis teres, c. 1·5 mm. lata, dense pubescens, denudata fulcris minutis involucrorum densiuscule obsita ; involucra sessilia, basi minute barbata, demum deflexa ; setae usque ad 70, gracillimae, rigidiusculae, inaequales, exteriores scaberulae et breviores, interiores (5–8) praeter apices spiculam superantes scaberulos ciliatae, terminalis ceteris validior, stricta vel paulo curvata et usque ad 3 cm. longa, ceterae inaequales usque ad 14 mm. longae. *Spiculae* solitariae, minute pedicellatae, lanceolato- vel ovato-oblongae, leviter gibbosae, 5·5–6 mm. longae, fere glabrae. *Gluma inferior* nulla vel minutissima ; gluma superior rotundata, latissima, usque ad 0·6 mm. longa, hyalina et enervis. *Anthoecium inferum* ♂ : lemma explanatum ovato-oblongum, apice late emarginatum vel obtusissimum, mucronulatum, spiculae aequilongum, firme membranaceum, 4–5-nerve ; palea lanceolata, lemmati aequilonga, dorso sparse pilosa, carinis scaberulis. *Anthoecium superum* ♀ : lemma explanatum late ovatum, obtusissimum, spiculae subaequilongum, mucronatum, chartaceum vel tenuiter coriaceum, 5-nerve, dorso infra apicem prominenter nervosum laevissimum et nitens, marginibus basin versus rigide ciliolatum ; palea lanceolata, acuminata, lemmati fere aequilonga, glabra vel basi pilis minutis praedita. *Lodiculae* nullae. *Antherae* 3·5 mm. longae, apicibus penicillatis. *Styli* connati.

North Bagirmi : Kolkélé and Moito, *Chevalier* 9757 bis.

Pennisetum (§ *Penicillaria*) **robustum** *Stapf et C. E. Hubbard*, sp. nov. ; affine *P. Chevalieri* Stapf et C. E. Hubbard, sed spiculis minoribus, spica spuria plerumque validiore usque ad 30 cm. longa et ad 2·5 cm. lata, lemmate inferiore plerumque trinervi, lemmate superiore prope margines scaberulo vel minute pubescente differt.

Gramen annuum, usque ad 3 m. altum. *Culmi* erecti vel geniculato-ascendentes, validi, ramosi, teretes vel in latere ad ramum spectante canaliculati, plurinodes, pilis deciduis e tuberculis ortis plerumque dense hirsuti vel glabri, nodis superioribus serie pilorum longorum densorum sericeorum obsitis. *Foliorum* vaginae internodiis plerumque breviores, laxae, teretes, striatae, pilis rigidis patentibus e tuberculis ortis hirsutae vel plus minusve glabrescentes et tuberculatae ; ligulae ad seriem ciliorum densorum redactae, pilis usque ad 5 mm. longis ; laminae lineares, basi contractae, tenuiter acutae, usque ad 30 cm. (vel ultra) longae et ad 2·5 cm. latae, planae, firmae, uti vaginae hirsutae vel fere glabrae, marginibus cartilagineis

scabridis, costa media valida. *Spica spuria* valida, densa, cylindrica, setosa, 10–30 cm. longa, 11–24 mm. lata (setis exclusis), aurea, demum fusca vel purpureo-tincta ; rhachis valida, teres, usque ad 4 mm. diametro, dense pubescens, denudata fulcris minutis pubescentibus involucrorum sublaxe obsita ; involucra sessilia vel subsessilia, demum patentia vel deflexa ; setae 50–60, gracillimae, rigidae, inaequales, exteriores breviores et scaberulae, interiores (6–16) praeter apices spiculam superantes scaberulos pilis albis ciliatae, terminalis usque ad 2·8 cm. longa et ceteris validior, ceterae usque ad 14 mm. longae. *Spiculae* binae vel solitariae, pedicellatae, pedicellis usque ad 1 mm. longis, lanceolatae, oblongae vel ovato-oblongae, paulo gibbosae, 3·5–4·5 mm. longae, fere glabrae. *Glumae* tenuissimae ; inferior ovata, obtusa, 0·5-0·7 mm. longa, enervis, vel nulla ; superior oblata vel elliptica, truncata vel obtusissima, usque ad 3 mm. longa, enervis vel 1–3-nervis. *Anthoecium inferum* ♂ vel sterile : lemma explanatum ovato-oblongum vel oblongum, apice late emarginatum vel truncatum, spiculae aequilongum vel plerumque paulo brevius, firme membranaceum, 3–5-nerve, apicem versus nervis scaberulum, vel usque ad 1·5 mm. longum et 1–3-nerve redactum ; palea linearis vel anguste lanceolata, obtusa, lemmati fere aequilonga, dorso minute hirsuta, carinis scaberulis, vel nulla. *Anthoecium superum* ♀ : lemma explanatum late ovatum, obtusum vel truncatum, spiculae aequilongum, mucronulatum, chartaceum, tenuiter coriaceum, 5–6-nerve, prope margines supra medium scaberulum et nonnunquam minute pubescens, dorso infra apicem prominenter nervosum laeve et nitens ; palea lemmati aequilonga, dorso tenuiter coriacea et glabra, marginibus tenuibus basin versus minute hirsuta vel glabra, carinis scaberulis. *Lodiculae* nullae. *Antherae* 2 mm. longae, apicibus penicillatis. *Styli* connati. *Caryopsis* oblongo-ellipsoidea vel oblongo-ovoidea, transverse subrotunda vel dorso paulo compressa, 2–2·5 mm. longa, inter lemma paleamque inclusa.

Angola : Cuanza Norte, Casoneca, perhaps an escape from cultivation, *Gossweiler* 8324 (type) ; Loanda, in thickets between Penedo and Conceiçao, *Welwitsch* 7278 ; Loanda, rather rare in fields once cultivated and in abandoned gardens, *Welwitsch* 7321 ; Golungo Alto, near Sange, in grassy places, *Welwitsch* 7275 ; between Sange and Menha-Lula, on grassy hills, *Welwitsch* 7276 ; spontaneous on the left bank of the Quiapose stream near Sanches, *Welwitsch* 7276 b.

Vern. name : *Massango*.

Welwitsch notes that this grass is cultivated by the natives and more rarely by the settlers, but that it also is spontaneous everywhere.

Pennisetum (§ *Penicillaria*) **Barteri** *Stapf et C. E. Hubbard*, sp. nov. ; affine *P. violaceo* L. Rich., sed culmis altioribus, spica spuria longiore albido-sericeo, setis tenuioribus differt.

Gramen annuum (?) ; basis ingota. *Culmi* graciles, 1·2 m. alti, compressi, ramosi, in latere ad ramum spectante canaliculati, spicam spuriam versus pubescentes, ad nodos pilis albis sericeis barbati, ceterum glabri laevesque. *Foliorum* vaginae (superiores) internodiis breviores, striatae, pilis brevibus deciduis e tuberculis ortis laxe hirsutae, os versus ad margines ciliatae, ad dorsum summum serie pilorum sericeorum praeditae ; ligulae ad seriem ciliorum densorum redactae, pilis usque 3 mm. longis ; laminae lineares, basi paulo contractae, acutae, usque ad 15 cm. (vel ultra) longae et ad 10 mm. latae, planae vel complicatae, firmae, sparse hirsutae, supra scaberulae, marginibus cartilagineis laevibus. *Spica spuria* densa, cylindrica, albido-sericea, 10–11 cm. longa, 12 mm. lata (setis exclusis) ; rhachis gracilis, villosula, denudata fulcris minutis involucrorum densiuscule obsita ; involucra sessilia, demum patentia ; setae usque ad 75, subcapillares, mollissimae, exteriores scaberulae et breviores, interiores (20–22) praeter apices scaberulos spiculam superantes pilis albis sericeis plumosae, terminalis ceteris paulo validior et usque ad 13 mm. longa, ceterae subaequales et usque ad 9 mm. longae. *Spiculae* solitariae, pedicellatae, pedicellis usque ad 1·2 mm. longis, ambitu anguste lanceolatae, dorso lanceolatae et acutae, 4–4·5 mm. longae, glabrae. *Glumae* nullae vel superior minutissima, hyalina. *Anthoecium inferum* sterile : lemma oblatum, usque ad 0·5 mm. longum, hyalinum, uninerve vel enerve ; palea nulla. *Anthoecium superum* ♀ : lemma explanatum ovatum, late obtusum, spiculae aequilongum, mucronulatum, apicem versus marginibus tenuibus exceptis chartaceum, 5-nerve, dorso laeve et nitens, apicem versus prominenter nervosum et asperulum ; palea lanceolata, minute truncata, lemmati aequilonga, glabra laevisque. *Lodiculae* nullae. *Antherae* c. 2 mm. longae, apicibus penicillatis. *Styli* connati.

Northern Nigeria : Nupe, in cultivated fields, *Barter* 1376.

Pennisetum (§ *Penicillaria*) **sclerocladum** *Stapf et C. E. Hubbard*, sp. nov. ; affine *P. stenostachyo* Stapf et C. E. Hubbard, sed spica spuria validiore, setis terminalibus longioribus, lemmati inferiore late elliptico- vel ovato-oblongo, lemmate superiore latiore marginibus pubescentibus differt.

Gramen annuum. *Culmi* laxe fasciculati, suberecti, 90–120 cm. alti, subvalidi, teretes vel in latere ad ramum spectante canaliculati, simplices vel ramosi, 4–5-nodes, spicam spuriam versus dense pubescentes, nodis superioribus plerumque breviter barbati, ceterum glabri laevesque. *Foliorum* vaginae teretes, internodiis breviores, firmae, glabrae vel ad dorsum summum minute barbatae ; ligulae ad seriem ciliorum densorum redactae, pilis usque ad 3 mm. longis ; laminae lineares, basi leviter contractae, acutae, usque ad 15 cm. longae (superiores) et ad 1 cm. latae, planae, firmae, glauco-virides, glabrae laevesque, marginibus cartilagineis, costa media gracili. *Spica spuria* densa, cylindrica, 9–23 cm. longa, 13–14 mm. lata (setis exclusis), aurea, demum pallide fusca ; rhachis teres, usque ad

2·5 mm. lata, dense pubescens vel villosa, denudata fulcris minutis involucrorum dense obsita ; involucra subsessilia, basi minute barbata, demum leviter deflexa ; setae usque ad 80, gracillimae, rigidulae, inaequales, exteriores scaberulae et breviores, interiores (5–10) praeter apices spiculam superantes scaberulos ciliatae, terminalis ceteris validior et usque ad 18 mm. longa, ceterae inaequales et usque ad 10 mm. longae. *Spiculae* binae vel solitariae, pedicellatae, pedicellis usque ad 0·5 mm. longis, lanceolatae, late ovatae vel elliptico-oblongae, 4–4·5 mm. longae, leviter gibbosae. *Glumae* rotundatae, subaequales vel inferior brevior vel nulla, usque ad 1 mm. longae, apice ciliolatae, hyalinae, enerves vel superior 2-nervis. *Anthoecium inferum* ♂ vel sterile : lemma explanatum late elliptico- vel ovato-oblongum, truncatum vel emarginatum, spiculae aequilongum vel brevius, firme membranaceum, 3–5 nerve, apice ciliolatum, vel plus minusve redactum usque ad 1·5 mm. longum et tenuius ; palea anguste elliptica, truncata, lemmati aequilonga, adpresse pubescens, carinis scaberulis, vel nulla. *Anthoecium superum* ♀ : lemma explanatum late ovatum, obtusissimum, spiculae aequilongum, mucronulatum, tenuiter coriaceum, 5-nerve, prope margines pubescens, infra apicem prominenter nervosum scaberulum laeve et nitens ; palea lanceolata vel ovata, obtusa, lemmati subaequilonga, adpresse pubescens, apice ciliolata. *Lodiculae* nullae. *Antherae* 1·5 mm. longae, apicibus penicillatis. *Styli* connati. *Caryopsis* ellipsoidea vel obovoidea, 2–2·5 mm. longa, inter lemma paleamque inclusa.

Gambia : near Georgetown, in cultivated fields, *Sampson* 56.

Pennisetum (§ *Penicillaria*) **Sampsonii** *Stapf et C. E. Hubbard*, sp. nov. ; affine *P. Perrottetii* K. Schum., sed culmis altioribus, laminis latioribus firmioribus, spica spuria gracili, setis brevioribus tenuioribus, spiculis brevioribus, anthoecio infero sterili differt.

Gramen annuum. *Culmi* erecti, usque ad 2·7 m. alti, validi, usque ad 1 cm. lati, basi paulo compressi, ramosi, nodis usque ad 12, superne teretes vel in latere ad ramum spectante canaliculati, spicam spuriam versus pubescentes, ad nodos plerumque pilosi vel villosi, ceterum glabri laevesque. *Foliorum* vaginae internodiis plerumque breviores, teretes, validae, laeves, os versus ciliatae, ad dorsum summum saepe dense barbatae, ceterum glabrae ; ligulae brevissimae, truncatae, pilis sericeis usque ad 4 mm. longis dense ciliatae ; laminae lanceolato-lineares, basi abrupte contractae vel paulo rotundatae, acutae, usque ad 1·2 m. longae et ad 3·5 cm. latae, planae, firmae, basin versus pilis e tuberculis ortis laxe hirsutae, ceterum glabrae, leviter scaberulae vel subtus laeves, marginibus cartilagineis minute serrato-scabridis, costa media valida. *Spica spuria* densa, cylindrica, 10–18 cm. longa, 10–12 mm. lata, sericea, purpurea ; rhachis gracilis, teres, dense pubescens vel villosula, denudata fulcris minutissimis involucrorum dense obsita ; involucra subsessilia, demum patentia ; setae usque ad 60–80, gracillimae, exteriores scaberulae et breviores, interiores (20–24)

apicibus scaberulis exceptis pilis albis vel purpureis sericeis e tuberculis ortis plumosae, subaequales, spiculis subaequilongae vel leviter longiores. *Spiculae* solitariae vel binae, minute pedicellatae, anguste lanceolatae vel ovato-oblongae, acutae, leviter gibbosae, 3·5–4 mm. longae. *Glumae* oblatae, apice ciliolato rotundatae, hyalinae, enerves; inferior usque ad 0·5 mm. longa vel nulla; superior usque ad 0·6 mm. longa. *Anthoecium inferum* sterile: lemma late oblongum vel oblatum, apice ciliolato truncatum vel rotundatum, usque ad 2·5 mm. longum, tenuiter membranaceum, 3–4-nerve; palea nulla. *Anthoecium superum* ♀: lemma explanatum late ovatum, obtusissimum, spiculae aequilongum, mucronulatum, 5-nerve, marginibus membranaceis exceptis tenuiter coriaceum, prope margines pubescens, dorso infra apicem nervosum laeve et nitens; palea lanceolata, minute truncata, lemmati aequilonga, dorso coriaceo excepto adpresse pubescens. *Lodiculae* nullae. *Antherae* 2–2·5 mm. longae, apicibus penicillatis. *Styli* connati. *Caryopsis* obovoida, 2 mm. longa, inter lemma paleamque inclusa.

Northern Nigeria: Ilorin, in cultivated land, *Sampson* 44.

Pennisetum (§ *Penicillaria*) **Dalzielii** *Stapf et C. E. Hubbard*, sp. nov.; affine *P. Gymnothrici* K. Schum., sed spica spuria longiore, spiculis ovato-oblongis brevioribus, lemmate superiore late ovato-elliptico ad margines pubescentibus differt.

Gramen annuum (?); basis ignota. *Culmi* erecti, usque ad 2·5 m. alti, validi, superne ramosi, teretes vel in latere ad ramum spectante canaliculati, plurinodes, ad nodos plus minusve barbati, spicam spuriam versus dense pubescentes vel villosi, ceterum plerumque glabri laevesque. *Foliorum* vaginae internodiis breviores, teretes, os versus ad margines ciliatae, ad dorsum summum saepe dense barbatae, vel glabrae, laeves vel superiores laminam versus minute scaberulae; ligulae ad seriem ciliorum densorum redactae, pilis 3–6 mm. longis; laminae lineares, basi leviter contractae vel attenuatae, tenuiter acutae, usque ad 45 cm. (vel ultra) longae, 12–24 mm. latae, planae, rigidiusculae, virides, pilis brevibus e tuberculis ortis sparse hirsutae vel glabrae, scaberulae vel subtus laeves, marginibus plus minusve scabridis. *Spica spuria* cylindrica, densa, erecta, 11–25 cm. longa, 12–16 mm. lata (setis exclusis), straminea vel purpurea; rhachis valida, teres, villosa, denudata fulcris minutis involucrorum densiuscule obsita; involucra sessilia, demum patentia vel deflexa; setae usque ad 60, gracillimae, inaequales, scaberulae, interiores usque ad 10 mm. longae vel una ceteris paulo validior et usque ad 12 mm. longa, ceterae breviores. *Spiculae* binae vel ternae, minute pedicellatae, ovato-oblongae vel oblongae, 4·5–6·5 mm. longae, leviter gibbosae. *Glumae* oblongae vel elliptico-oblongae, obtusissimae vel rotundatae, ciliolatae, tenuissimae; inferior nulla vel usque ad 1 mm. longa, enervis; superior usque ad 3 mm. longa, enervis vel uninervis. *Anthoecium inferum* ♂: lemma explanatum oblongum, truncatum vel

emarginatum, spiculae subaequilongum, plerumque mucronulatum, firme membranaceum, 3–5-nerve, apice ciliolatum ; palea linearis, truncata, lemmati aequilonga, carinis scaberulis et pilis paucis praedita. *Anthoecium superum* ♀ : lemma explanatum late ovato-ellipticum, late obtusum vel apice rotundatum, spiculae aequilongum, mucronulatum, chartaceum, 5–7-nerve, prope margines breviter pilosum, infra apicem prominenter nervosum scaberulum laeve et nitens ; palea lemmati aequilonga, firma, basin versus leviter pilosa. *Lodiculae* nullae. *Antherae* usque ad 4 mm. longae, apicibus penicillatis. *Styli* connati.

NORTHERN NIGERIA : Sokoto Province, *Dalziel* 511, 512 (type), 513.

Vern. name : *Shibra* or *Shura*.

Pennisetum (§ *Penicillaria*) **perspeciosum** *Stapf et C. E. Hubbard*, sp. nov. ; affine *P. vulpino* Stapf et C. E. Hubbard, sed spiculis longioribus, fasciculis pedunculatis, spica spuria longiore differt.

Gramen annuum (?) ; basis ignota. *Culmi* validi, alti, ramosi, ramis erectis, teretes, spicam spuriam versus villosi, ad nodos serie pilorum densorum praediti, ceterum glabri laevesque. *Foliorum* vaginae, laxae, teretes, internodiis longiores, striatae, glabrae laevesque; ligulae ad seriem cilorum redactae ; laminae lanceolatae, basi contractae, acutae, usque ad 60 cm. (vel ultra) longae et ad 3 cm. latae, planae, firmae, scaberulae vel subtus fere laeves, glabrae, costa media valida. *Spica spuria* densa, ambitu lineari-lanceolata, 24 cm. longa, 22 mm. lata (setis inclusis), subfusca ; rhachis moderate valida, teres, villosa, pedunculis villosis usque ad 5 mm. longis involucrorum persistentium leviter patentium densiuscule obsita ; setae usque ad 50, gracillimae, inaequales, exteriores scaberulae, interiores (6–10) praeter apices spiculam superantes scaberulos pilis e tuberculis ortis laxe plumosae, subaequales et spiculae aequilongae, ceterae plerumque breviores. *Spiculae* solitariae vel binae, pedicellatae, pedicellis usque ad 1 mm. longis, lanceolatae vel anguste oblongae, 7–8·5 mm. longae, fere glabrae. *Glumae* oblatae, truncatae vel rotundatae, usque ad 1·2 mm. longae, hyalinae, enerves. *Anthoecium inferum* ♂ : lemma explanatum ovato-oblongum vel oblongum, subacutum vel obtusum et mucronatum, spiculae fere aequilongum, firme membranaceum, 3–4-nerve, nervis scaberulis ; palea lineari-lanceolata, minute truncata, lemmati fere aequilonga, carinis scaberulis. *Anthoecium superum* ♀ : lemma explanatum ovatum, subacutum vel obtusum et mucronatum, spiculae aequilongum, chartaceum, 7-nerve, infra apicem prominenter nervosum laeve et nitens, prope margines scaberulae et pilis brevibus paucis praeditum ; palea linearis, lemmati fere aequilonga. *Lodiculae nullae*. *Antherae* 4 mm. longae, apicibus penicillatis. *Styli* connati.

SUDAN : near Berber (El Mecherif), cultivated, *Schweinfurth* 643 (in part).

Pennisetum perspeciosum var. **Lynesii** *Stapf et C. E. Hubbard*, var. nov.

Pedunculus (internodium summum) infra spicam spuriam tenuiter striatus et fere glabrus. *Spica spuria* 18 cm. longa, 22 mm. lata (setis exclusis), pallide viridis et setis purpureis; setae 15–18, interiores leviter inaequales, usque ad 15 mm. longae, circiter quorum 8 praeter apices spiculam superantes plumosae. *Anthoecium inferum*: lemma truncatum, mucronatum, 5-nerve. *Anthoecium superum*: lemma glabrum, 9-nerve. *Caryopsis* late obovata, dorso compressa, 3 mm. longa, inter lemma et paleam inclusa.

SUDAN: Blue Nile, cultivated, *Lynes* (type in Herb. Mus. Brit.).

Pennisetum (§ *Penicillaria*) **orthochaete** *Stapf et C. E. Hubbard*, sp. nov.; affine *P. perspecioso* Stapf et C. E. Hubbard, sed setis terminalibus rigidis valde elongatis, fasciculis breviter pedunculatis differt.

Gramen annuum (?); basis ignota. *Culmi* erecti, alti, validi, ramosi, in latere ad ramum spectante canaliculati vel complanati, plurinodes, ad nodos superioribus breviter barbati, spicam spuriam versus dense pubescentes, ceterum glabri laevesque. *Foliorum* vaginae internodiis demum breviores, laxae, teretes, glabrae laevesque; ligulae ad seriem ciliorum densorum redactae, pilis usque ad 5 mm. longis; laminae lineares, basi leviter contractae, tenuiter acutae, usque ad 60 cm. (vel ultra) longae et 24 mm. latae, planae, firmae, glabrae, virides, subtus laeves, supra et ad margines scaberulae, costa media valida. *Spica spuria* densa, cylindrica sed superne attenuata, usque ad 30 cm. longa et 22 mm. lata (setis exclusis), setosa, straminea; rhachis valida, teres, tuberculata, dense pubescens, fulcris minutis involucrorum laxe obsita; involucra demum patentia, pedunculis usque ad 1·5 mm. longis; setae usque ad 50, gracillimae, rigidulae, inaequales, exteriores scaberulae, interiores (4–9) inferne pilis longis e tuberculis ortis laxe ciliatae, superne scaberulae, terminalis ceteris multo validior et usque ad 28 mm. longa, ceterae usque ad 11 mm. longae. *Spiculae* solitariae vel raro binae, pedicellatae, pedicellis usque ad 1 mm. longis, lanceolatae et acutae vel oblongae et hiantes, 8–9 mm. longae, leviter gibbosae, glabrae. *Gluma* inferior nulla; gluma superior oblata, truncata, c. 1 mm. longa, membranacea, enervis. *Anthoecium inferum* ♂: lemma explanatum oblongum vel lanceolato-oblongum, subacutum, mucronulatum, 7–8 mm. longum, firme membranaceum, 4–7-nerve, nervis apicem versus scaberulis; palea linearis, minute truncata, lemmate paulo brevior, carinis scaberulis. *Anthoecium superum* ♀: lemma explanatum late elliptico-lanceolatum vel elliptico-ovatum, acuminatum, mucronatum, spiculae aequilongum, chartaceum, 7–9-nerve, dorso infra apicem prominenter nervosum scaberulum laeve et nitens; palea lanceolata, minute truncata, c. 7 mm. longa, dorso chartacea. *Lodiculae* nullae. *Antherae* 4·5–5 mm. longae, apicibus penicillatis. *Styli* connati.

SUDAN: near Berber (El Mecherif), cultivated, *Schweinfurth* 643 (in part).

Pennisetum (§ *Penicillaria*) **niloticum** *Stapf et C. E. Hubbard*, sp. nov. ; affine *P. vulpino* Stapf et C. E. Hubbard, sed spica spuria longiore, spiculis plerumque brevioribus, setis brevioribus differt.

Gramen annuum. *Culmi* validi, 1·8–2·4 m. alti, nodis superioribus dense barbati, spicam spuriam versus tomentosi. *Foliorum* vaginae (superiores) teretes, firmae, ad dorsum summum dense barbatae, ceterum glabrae laevesque ; ligulae ad seriem ciliorum densorum redactae, pilis usque 4 mm. longis ; laminae lanceolatae, basi plerumque rotundatae, tenuiter acutae, usque ad 60 cm. (vel ultra) longae, 20–32 mm. latae, planae, firmae, pilis e tuberculis ortis hirsutae vel glabrae, supra scaberulae vel marginibus cartilagineis scabridis exceptis laeves. *Spica spuria* densa, cylindrica, 15–23 cm. longa, 14–16 mm. lata (setis exclusis), straminea, aurea vel purpurascens ; rhachis valida, teres, dense tomentosa, denudata fulcris minutis involucrorum dense obsita ; involucra sessilia vel minutissime pedunculata, demum patentia vel deflexa ; setae usque ad 90, gracillimae, exteriores scaberulae et breviores, interiores (usque ad 30) apicibus scaberulis exceptis plumosae, subaequales et usque ad 7 mm. longae vel terminalis usque ad 9 mm. longa. *Spiculae* solitariae vel binae, minute pedicellatae, oblongae vel ovato-oblongae, leviter gibbosae, 4–5·5 mm. longae. *Glumae* oblatae, truncatae, hyalinae, minute ciliolatae, enerves ; inferior 0·5–0·6 mm. longa ; superior 0·6–1 mm. longa. *Anthoecium inferum* ♂ : lemma explanatum oblongum vel elliptico-oblongum, apice latum et leviter emarginatum, spicula paulo brevius, firme membranaceum, 4–5-nerve, apicem ciliolatum versus scaberulum ; palea lanceolato-oblonga, truncata, adpresse pubescens vel glabra. *Anthoecium superum* ♀ : lemma explanatum late ovatum, obtusissimum, mucronatum, spiculae aequilongum, tenuiter coriaceum, 5-nerve, prope margines breviter pilosum, infra apicem prominenter nervosum laeve et nitens ; palea lemmati aequilonga, angusta, firma, basi pilosa vel glabra. *Lodiculae* nullae. *Antherae* 3 mm. longae, apicibus penicillatis. *Styli* connati.

Senegambia : Galom, *Heudelot* 299 (in part).

Cameroons : Adamaua ; Bidene, *Houy* 13.

Sudan : Blue Nile ; Fazogl (?), *Figari* (type) ; Gallabat ; Matamma, *Schweinfurth* 1516 (Herb. Kew).

Also in Egypt (*Bové* 275, 276). Cultivated.

It may be pointed out that the species of *Pennisetum* (sect. *Penicillaria*) here described (from *P. ancylochaete* to *P. gibbosum*) are artificially defined groups rather than natural species. They have been given binominal names for brevity and convenience, and for the same reasons that guided one of us in the treatment of the corresponding artificial units of *Sorghum*, sect. *Eu-sorghum*, in the Flora of Tropical Africa (**9**, pt. 1, 105). They may be useful as provisional centres around which the agriculturist may group the numerous minor cultivated strains which he encounters in the pearl-millet fields, pending a better understanding of their genetic

relationships. They come under the general but equally artificial concept of Koernicke's *Pennisetum spicatum*. The species of *Pennisetum* which precede them in this article (*P. robustum* to *P. niloticum*) are so far known only from cultivated ground, and represent types which appear to be independent units, some of them intruders into cultivation and others reversions to wild types.

Pennisetum (§ *Penicillaria*) **ancylochaete** *Stapf et C. E. Hubbard*, sp. nov. ; affine *P. pycnostachyo* Stapf et C. E. Hubbard, sed spiculis plerumque solitariis paulo majoribus, lemmate superiore 7–9-nervi, fasciculis subsessilibus vel brevissime pedunculatis, setis terminalibus curvatis differt.

Gramen annuum. *Culmi* validi, teretes, ad nodum superiorem pilosi, spicam spuriam versus dense pubescentes. *Foliorum* vaginae teretes, striatae, ad margines ciliatae, ad dorsum summum dense barbatae, ceterum glabrae laevesque ; ligulae ad seriem ciliorum densorum redactae ; laminae basi contractae, 2·4 cm. latae, glabrae, subtus laeves, supra et ad margines scaberulae. *Spica spuria* cylindrica, densa, setosa, stricta, rigida, 45 cm. longa, 2 cm. lata (setis exclusis), atropurpurea ; rhachis valida, 6 mm. lata, teres, dense pubescens, pedunculis dense pubescentibus usque ad 1 mm. longis involucrorum persistentium patentium dense obsita ; setae usque ad 65, exteriores scaberulae, gracillimae, breviores, interiores validiores, quorum 3–5 basin versus sparse ciliatae, superne scaberulae, terminalis ceteris multo validior curvata et 12–18 mm. longa, ceterae usque ad 9 mm. longae. *Spiculae* plerumque solitariae, rarissime binae, pedicellatae, pedicellis 1·5 mm. longis, elliptico-oblongae, 4–4·5 mm. longae. *Glumae* late oblongae vel oblatae, truncatae, subaequales, c. 2 mm. longae, hyalinae, enerves, ciliolatae. *Anthoecium inferum* ♂ : lemma explanatum latissime oblongum, truncatum vel leviter emarginatum, spiculae aequilongum, firme membranaceum, 7–8-nerve, apice ciliolatum ; palea oblonga, truncata, lemmati subaequilonga, adpresse pilosa. *Anthoecium superum* ♀ : lemma explanatum latissime ovato-ellipticum vel subrotundum, mucronulatum, spiculae aequilongum, 7–9-nerve, tenuiter coriaceum, dorso infra apicem laeve et nitens, supra medium prope margines pilosum ; palea lemmati subaequilonga, firma, adpresse pilosa.

Northern Nigeria : Katagum District, cultivated, *Dalziel* 294.

Pennisetum (§ *Penicillaria*) **albicauda** *Stapf et C. E. Hubbard*, sp. nov. ; affine *P. echinuro* Stapf et C. E. Hubbard, sed spica spuria pallida, spiculis majoribus, caryopsi quam lemma et palea conspicue breviore, lemmate superiore chartaceo marginibus tenuibus differt.

Gramen annuum. *Culmi* validi, usque ad 2·5 m. alti, infra spicam spuriam dense pilosi. *Folia* glabra. *Spica spuria* moderate densa, subcylindrica, apicem et basin versus attenuata, 21–28 cm. longa, 22–30 mm. lata (setis exclusis), pallida ; rhachis valida, teres, pilosa, pedunculis patentibus involucrorum persistentium densiuscule obsita ; pedunculi 5–7 mm. longi, pilis longis patentibus laxe pilosi ;

setae usque ad 70, gracillimae, exteriores breviores et scaberulae, interiores (12–18) apicibus scaberulis exceptis pilis longis e tuberculis ortis laxe plumosae, terminalis ceteris validior et 10–28 mm. longa basin versus plumosa, ceterae spiculae aequilongae vel usque ad 14 mm. longae. *Spiculae* 2–5-nae fasciculatae, pedicellatae, pedicellis 2 mm. longis, late oblongae vel elliptico-oblongae, 4·5-6 mm. longae. *Glumae* latissimae, truncatae vel obtusissimae, hyalinae vel tenuiter membranaceae; inferior usque ad 0·6 mm. longa, enervis; superior usque ad 2·5 mm. longa, enervis vel 1–4-nervis. *Anthoecium inferum* ♂: lemma explanatum late elliptico-oblongum, apice latum et leviter emarginatum, spicula paulo brevius, membranaceum, marginibus tenuibus, 5–7-nerve, apice ciliolatum; palea lemmati aequilonga, lanceolato- vel elliptico-oblonga, plus minusve adpresse pilosa. *Anthoecium superum* ♀: lemma explanatum late ovatum, obtusissimum, mucronatum, spiculae aequilongum, 5–7-nerve, chartaceum, supra basin prope margines pubescens, dorso infra apicem prominenter nervosum laeve et nitens; palea lemmati subaequilonga, plus minusve adpresse pilosa. *Caryopsis* late obovoidea vel obovoideo-ellipsoidea, 2·5–3 mm. longa, inter lemma et paleam hiantes inclusa.

South West African Protectorate: Ovamboland, cultivated, *Hahn*.

Vern. name: *Omuhango*.

Pennisetum (§*Penicillaria*) **malacochaete** *Stapf et C. E. Hubbard*, sp. nov.; affine *P. echinuro* Stapf et C. E. Hubbard, sed anthoecio infero plerumque sterili, lemmate inferiore plerumque 1–1·5 mm. longo, spica spuria cylindrica, pedunculis 2–6 mm. longis differt.

Gramen annuum. *Culmi* validi, ad nodum supremum barbati, infra spicam spuriam tomentosi, ceterum glabri. *Foliorum* vaginae ad dorsum summum dense barbatae; ligulae ad seriem ciliorum densorum redactae; laminae lanceolato-lineares, acutae, usque ad 45 cm. longae et 2 cm. latae, glabrae, supra scaberulae. *Spica spuria* densa, cylindrica, setosa, 10–23 cm. longa, 13–24 mm. lata (setis exclusis), fusca vel purpurea; rhachis valida, usque ad 5 mm. lata, teres, dense pubescens; involucra persistentia, patentia vel deflexa, pedunculis pilosis 2–6 mm. longis suffulta; setae usque ad 70, exteriores gracillimae scaberulae breviores, interiores (6–12) molles, praeter apices spiculam superantes scaberulos ciliatae, terminalis ceteris validior et 12–26 mm. longa, ceterae usque ad 7–13 mm. longae. *Spiculae* plerumque binae, pedicellatae, pedicellis 1·5–2 mm. longis, lanceolato-oblongae vel oblongae, 3–4 mm. longae, fere glabrae. *Gluma* inferior nulla vel minutissima; gluma superior oblata, truncata, usque ad 0·5 mm. longa, hyalina, enervis. *Anthoecium inferum* plerumque sterile, raro ♂: lemma oblatum vel latissime elliptico-oblongum, truncatum vel leviter emarginatum, mucronulatum, 1–1·5 mm. longum, glabrum, 3–7-nerve, raro ovato-oblongum et spiculae aequilongum; palea raro lemmati aequilonga et inter carinas laxe pilosa, plerumque nulla. *Anthoecium superum*

♀ : lemma explanatum late ovatum, obtusissimum, mucronatum, spiculae aequilongum, 5–7-nerve, tenuiter coriaceum, supra medium prope margines scaberulum et pilis minutis paucis praeditum, dorso nitens et laeve ; palea basin versus leviter pilosa. *Caryopsis* ellipsoidea, 3 mm. longa, 1·5 mm. lata, inter lemma et paleam hiantes breviter exserta.

Tanganyika Territory : Daressalam, Usonga, *Holz* 578 ; Noto Plateau, *Busse* 2918 ; Lindi, *Busse* 2331 ; Rovuma, *Kirk* (type).

Cultivated near the Rovuma River.

Pennisetum (§ *Penicillaria*) **leonis** *Stapf et C. E. Hubbard*, sp. nov. ; affine *P. nigritarum* Durand & Schinz, sed setis interioribus (6–10) plumosis, spiculis paulo brevioribus, lemmate inferiore 3–5-nervi, superiore 5-nervi, caryopsibus oblanceolatis vel anguste ellipticis acutis vel obtusis transverse rotundis differt.

Gramen annuum. *Culmi* validi, 1·8–3·0 m. alti, simplices vel leviter ramosi, spicam spuriam versus villosi. *Foliorum* vaginae marginibus ciliatae, ad dorsum summum dense barbatae, vel glabrae ; ligulae ad seriem ciliorum longorum redactae ; laminae lanceolato-lineares, acutae, usque ad 60 cm. (vel ultra) longae et 3·6 cm. latae, glabrae. *Spica spuria* densissima, cylindrica, rigida, 20–45 cm. longa, 14–30 mm. lata, pallida ; rhachis valida, teres, usque ad 1 cm. lata, villosa ; involucra patentia, subpersistentia, pedunculis pilosis 1–7 mm. longis suffulta ; setae usque ad 50, gracillimae, rigidae, exteriores scaberulae et breviores, interiores subaequales, usque ad 5 mm. longae, 6–10 apicibus scaberulis exceptis ciliatae vel plumosae. *Spiculae* plerumque binae, vel solitariae, pedicellatae, pedicellis c. 1 mm. longis, oblongae vel elliptico-oblongae, 3–4·5 mm. longae. *Glumae* latae, truncatae vel obtusissimae, tenuiter membranaceae, ciliolatae ; inferior 0·5–0·6 mm. longa, enervis ; superior 1–1·5 mm. longa, 1–3-nervis. *Anthoecium inferum* ♂ vel sterile : lemma explanatum late oblongum vel elliptico-oblongum, truncatum, spiculae aequilongum, 3–5-nerve, firme membranaceum, ciliolatum, nonnunquam prope margines pubescens, vel plus minusve redactum ; palea lanceolato-oblonga, lemmati aequilonga, adpresse pilosa, vel nulla. *Anthoecium superum* ♀ : lemma explanatum latissime ovatum vel ovato-ellipticum, obtusissimum, mucronulatum, spiculae aequilongum, 5-nerve, coriaceum, supra basin prope margines dense pilosum, dorso laeve et nitens ; palea lemmati aequilonga, dorso coriaceo excepto pilosa. *Caryopsis* ambitu oblanceolata vel anguste elliptica, acuta vel obtusa, transverse rotunda, 3–5 mm. longa, 1·5–2 mm. lata, ex apicibus lemmatis paleaeque distincte exserta.

Sierra Leone : Njala, *Deighton* 1796 (type) ; Port Lokko, *Sampson* 49 ; Kamalu, *Thomas* 350 ; without precise locality, *Afzelius, Glanville*.

Vern. names : *Gbele-Nuie* (Mende) ; *Tasure* (Temne).

The chief pearl millet cultivated in Sierra Leone.

Pennisetum (§ *Penicillaria*) **gambiense** *Stapf et C. E. Hubbard*, sp. nov. ; affine *P. nigritarum* Durand & Schinz, sed setis interioribus (6–18) ciliatis, spiculis brevioribus, caryopsibus transverse rotundis obtusis differt.

Gramen annuum. *Culmi* validi, 2·7–3·6 m. alti. *Foliorum* vaginae marginibus ciliatae, ad dorsum summum dense barbatae, vel glabrae ; ligulae ad seriem ciliorum densorum redactae ; laminae lineares, acutae, usque ad 60 cm. (vel ultra) longae et 2·5 cm. latae, glabrae. *Spica spuria* cylindrica, densissima, rigida, 30–60 cm. longa, 15–36 mm. lata, flavida ; rhachis valida, teres, usque ad 1 cm. lata, villosa ; involucra patentia, persistentia, pedunculis dense pilosis 2–8 mm. longis suffulta ; setae usque ad 90, gracillimae, ridigae, exteriores scaberulae et breviores, interiores validiores, subaequales, 6–18 usque ad 4 mm. ciliatae, usque ad 5·5 mm. longae. *Spiculae* 2–3-nae fasciculatae, pedicellatae, pedicellis 1 mm. longis, oblongae vel elliptico-oblongae, 3·5–4 mm. longae. *Glumae* latae, obtusissimae vel truncatae, tenuiter membranaceae, ciliolatae ; inferior 1–1·5 mm. longa, enervis ; superior 1·5–1·8 mm. longa, 1–3-nervis. *Anthoecium inferum* ♂ : lemma explanatum late elliptico-oblongum, apice latum leviter emarginatum vel truncatum, spicula paulo brevius, 5–7-nerve, firme membranaceum, ciliolatum ; palea anguste elliptico-oblonga, lemmati aequilonga, pilosa. *Anthoecium superum* ♀ : lemma explanatum latissime ellipticum, obtusissimum, mucronulatum, spiculae aequilongum, 5–7-nerve, coriaceum, prope margines dense pilosum, dorso laeve et nitens ; palea lemmati aequilonga, pilosa. *Caryopsis* turbinata, late vel anguste obovoidea, vel pyriformis, transverse rotunda, 3·2–4 mm. longa, e lemmati et palea exserta.

Gambia : throughout the country, *Pirie* 5, *Director of Agriculture* 13 (type), 14, 15, *Boteler*.

Gold Coast : without precise locality, *Thomas*.

Cultivated throughout Gambia.

Vern names :—*Suno, Sunno, Sanyo, Konba Sanyo* (Mandingo and Tarino).

Pennisetum (§ *Penicillaria*) **Maiwa** *Stapf et C. E. Hubbard*, sp. nov. ; affine *P. nigritarum* Durand & Schinz, sed setis interioribus dense plumosis, lemmate inferiore prope margines pubescentibus vel pilosis apice ciliatis, lemmate superiore prope margines dense barbatis, caryopsibus late obovoideo-globosis differt.

Gramen annuum. *Culmi* erecti, 1·8–2·7 m. alti, validi, simplices, nodis usque ad 7 superioribus serie pilorum densorum praeditis, spicam spuriam versus tomentosi, ceterum glabri laevesque. *Foliorum* vaginae internodiis plerumque breviores, marginibus ciliatae, ad dorsum summum dense barbatae, ceterum glabrae vel pilis e tuberculis ortis laxe hirsutae ; ligulae ad seriem ciliorum longorum redactae ; laminae lineares, acutae, usque ad 60 cm. (vel ultra) longae et 3 cm. latae, glabrae. *Spica spuria* densissima, cylindrica, 25–45 cm. longa, 13–20 mm. lata (setis inclusis), canescens ;

rhachis valida, dense villosa ; involucra patentia, persistentia, pedunculis dense pilosis 1–4 mm. longis suffulta ; setae usque ad 70, gracillimae, rigidulae, exteriores scaberulae et breviores, interiores (10–25) pilis sericeis dense plumosae vel apice scabridae, subaequales et usque ad 7 mm. longae. *Spiculae* solitariae vel binae, pedicellatae, pedicellis 1–1·5 mm. longis, elliptico-oblongae, 3–5·5 mm. longae. *Glumae* hyalinae, ciliolatae ; inferior late oblonga, truncata, 0·5–1·2 mm. longa, enervis ; superior oblata, rotundata, 0·6–2·4 mm. longa, enervis vel trinervis. *Anthoecium inferum* ♂ : lemma explanatum late elliptico-oblongum, apice latum et leviter emarginatum, spicula paulo brevius, firme membranaceum, 5–7-nerve, prope margines pubescens vel breviter pilosum, apice ciliatum ; palea oblonga, truncata, lemmati aequilonga, dense et adpresse pilosa. *Anthoecium superum* ♀ : lemma explanatum late elliptico-ovatum, obtusissimum, mucronatum, spiculae aequilongum, tenuiter coriaceum, 5–9-nerve, prope margines dense pilosum, dorso laeve et nitens ; palea lemmati aequilonga, firma, dense pilosa. *Caryposis* late obovoideo-globosa, 2–2·6 mm. longa, 2 mm. lata.

Southern Nigeria : Kafanshan, *Sampson* 41 (type).

Northern Nigeria : Ilorin, *Sampson* 43 ; Yandev, *Sampson* 32 ; Katagum District, *Dalziel* 295.

Vern. name : *Maiwa*.

This pearl millet has more densely hairy bristles and lemmas than any other commonly cultivated type.

Pennisetum (§ *Penicillaria*) **cinereum** *Stapf et C. E. Hubbard*, sp. nov. ; affine *P. nigritarum* Durand & Schinz, sed spica spuria multo breviore ambitu lineari-lanceolata, pedunculis longioribus, setis interioribus (5–7) laxe plumosis, spiculis minoribus differt.

Gramen annuum. *Culmi* validi, ad nodum supremum breviter barbati vel glabri, spicam spuriam versus dense tomentosi, ceterum glabri. *Foliorum* vaginae pilis e tuberculis ortis hispidae vel glabrescentes vel superiores marginibus ciliatis et ad dorsum summum dense barbatum exceptis glabrae ; ligulae ad seriem ciliorum densorum redactae ; laminae lineari-lanceolatae, usque ad 75 cm. longae et 2·5 cm. latae, hispidae vel glabrae, scaberulae, marginibus spinuloso-scabridis. *Spica spuria* densa, ambitu lineari-lanceolata, 12–20 cm. longa, 20–22 mm. lata, cinerascens vel purpureo-tincta ; rhachis moderate valida, dense villosa ; involucra patentia, persistentia, pedunculis villosis usque ad 8 mm. longis suffulta ; setae 25–40, gracillimae, rigidulae, exteriores scaberulae et breviores, interiores subaequales, usque ad 5 mm. longae, 5–7 apicibus scaberulis exceptis laxe ciliatae. *Spiculae* 2–3-fasciculatae, pedicellatae, pedicellis 1 mm. longis, oblongae vel elliptico-oblongae, 3–4 mm. longae. *Glumae* truncatae, hyalinae, apice ciliolatae ; inferior oblonga, 0·5–1 mm. longa, enervis ; superior oblata, 0·6–1·2 mm. longa, enervis vel trinervis. *Anthoecium inferum* ♂ : lemma explanatum late elliptico-oblongum, apice leviter emarginatum, mucronulatum, spicula paulo brevius, firme membranaceum,

3–5-nerve, apice ciliatum ; palea anguste oblonga, truncata, lemmate paulo longior, adpresse pilosa, apice ciliata. *Anthoecium superum* ♀ : lemma explanatum latissime ovatum, obtusissimum, mucronatum, spiculae aequilongum, tenuiter coriaceum, 5–7-nerve, dorso laeve et nitens, prope margines dense pilosum ; palea lemmati aequilonga, firma, pilosa. *Caryopsis* obovoidea vel pyriformis, 3·5–4 mm. longa, 3 mm. lata.

Gold Coast : Tamale, cultivated, *Sampson* 5 (type) ; Northern Territories, cultivated *Williams* 520.

Pennisetum (§ *Penicillaria*) **gibbosum** *Stapf et C. E. Hubbard*, sp. nov. ; affine *P. nigritarum* Durand & Schinz, sed culmis et spica spuria multo brevioribus, spiculis minoribus differt.

Gramen annuum. *Culmi* erecti, usque ad 90 cm. alti, graciles, 3–4-nodes, compressi, ramosi, ramis erectis, ad nodos superiores plerumque breviter barbati, ad inferiores glabri vel pubescentes, spicam spuriam versus tomentosi vel villosi. *Foliorum* vaginae laxae, pilis patentibus e tuberculis ortis hirsutae, vel ad margines ciliatis et dorso summo barbato exceptis glabrae (vaginae superiores) ; ligulae ad seriem ciliorum densorum redactae ; laminae lineari-lanceolatae, basi contractae, acutae, 10–20 cm. longae, 8–11 mm. latae, planae, pilis brevibus e tuberculis ortis hirsutae, supra et ad margines scaberulae. *Spica spuria* densa, cylindrica, 3–7·5 cm. longa, 7–13 mm. lata, pallida vel purpurea ; rhachis gracilis, teres, dense villosa ; involucra persistentia vel decidua, subsessilia vel pedunculis usque ad 2 mm. longis suffulta, patentia ; setae usque ad 50, gracillimae, inaequales, exteriores scaberulae et breviores, interiores (usque ad 10) apicibus scaberulis exceptis plumosae, subaequales et usque ad 6 mm. longae, raro omnino scaberulae. *Spiculae* plerumque solitariae, raro binae, minute pedicellatae, oblongae vel late ellipticae, 3–4·5 mm. longae. *Glumae* latae, rotundatae vel truncatae, tenues, ciliolatae, enerves vel paucinerves, inferior usque ad 1 mm., superior usque ad 1·5 mm. longa, aut inferior vel utraque suppressa. *Anthoecium inferum* ♂ vel sterile : lemma explanatum late elliptico-oblongum, truncatum vel leviter emarginatum, spicula paulo brevius, firme membranaceum, 3–5-nerve, apice ciliolatum, vel ad squamam minutam tenuissimam redactum ; palea elliptico-oblonga, truncata, lemmati aequilonga vel eo brevior, adpresse pilosa vel glabrescens, vel nulla. *Anthoecium superum* ♀ : lemma explanatum latissime elliptico-ovatum, obtusissimum, mucronulatum, spiculae aequilongum, coriaceum, 5–9-nerve, prope margines pilosum vel pubescens vel scaberulum, dorso laeve et nitens; palea infero similis. *Caryopsis* late obovoidea, 3 mm. longa, 2·5 mm. lata, gibbosa, inter apices hiantes lemmatis paleaeque exposita.

Northern Nigeria : cultivated on the banks of Lake Chad, *Lamb* 109.

Vern. name : *Beri-beri* (Ligi).

Cenchrus perinvolucratus *Stapf et C. E. Hubbard*, sp. nov. ; affinis *C. cathartico* Delile, sed setis exterioribus magis numerosis

erectis vel leviter patentibus, interioribus dorso plerumque pubescentibus, spiculis paulo majoribus, gluma inferiore 1–3-nervi, gluma superiore 5-nervi differt.

Gramen annuum. *Culmi* erecti vel geniculato-ascendentes, nonnunquam basi decumbentes et e nodis inferioribus radicantes, 20–75 cm. alti, graciles, leviter compressi, simplices vel ramosi, 4–6-nodes, spicam spuriam versus scabridi, ceterum glabri laevesque. *Foliorum* vaginae compressae et carinatae, basalibus exceptis laevibus scaberulae, superiores internodiis breviores ; ligulae ad seriem brevem ciliorum redactae ; laminae lineares, tenuiter acutae, usque ad 20 cm. longae, 4–8 mm. latae, planae, glabrae, scaberulae. *Spica spuria* densa, cylindrica, 5·5–11·5 cm. longa, 12–14 mm. lata ; rhachis angulata, flexuosa, scaberula ; involucra minutissime pedunculata, erecta, 6–9 mm. longa ; setae numerosae, basi connatae, exteriores rigidae, teretes, spiniformes, demum patentes, inaequales, usque ad 4 mm. longae, retrorse scabridae, interiores (10–12) ceteris validiores, usque ad 8 mm. longae, deorsum incrassatae et ampliatae, infra medium ad marginem ciliatae, dorso 2–3-nerves, glabrae vel plerumque pubescentes, apice leviter patentes retrorse scabridae. *Spiculae* binae, sessiles, ovatae, acutae, 4–6 mm. longae. *Glumae* tenuiter membranaceae, apicem versus puberulae ; inferior ovata, acuta, c. 3 mm. longa, 1–3-nervis ; superior elliptico-ovata vel late ovata, obtusa, 3–4 mm. longa, 5-nervis. *Anthoecium inferum* sterile, raro ♂ : lemma gluma superiore simile, sed 3·5–5 mm. longum, obtusissimum, nonnunquam mucronulatum ; palea lanceolata, acuta, usque ad 5 mm. longa, carinis retrorse scabridis, vel nulla. *Anthoecium superum* ♀, ovatum, acuminatum : lemma explanatum late ovatum, subobtusum, mucronatum, spiculae aequilongum, demum crustaceum, 5–7-nerve ; palea ovata, lemmati aequilonga. *Antherae* 4 mm. longae. *Caryopsis* elliptico-oblonga, truncata, 2·5 mm. longa.

Zanzibar : on bare sandy ground, *Hildebrandt* 1094 (type). Fumba ; in clumps just above high water mark, in sand, also on Pemba, *Greenway* 1227.

Tanganyika Territory : Daressalam, sandy soil, *Marshall* 48.

Portuguese East Africa : Port Amelia, *Young*.

Isachne aethiopica *Stapf et C. E. Hubbard*, sp. nov. ; affinis *I. mauritianae* Kunth, sed laminis supra saepe scaberulis vel infra saepissime pilosis, spiculis leviter majoribus, glumis late ovatis vel ovato-ellipticis differt.

Gramen perenne. *Culmi* geniculato-ascendentes, e nodis inferioribus radicantes, usque ad 60 cm. alti, graciles, teretes, multinodes, laxe ramosi, glabri laevesque. *Foliorum* vaginae plerumque internodiis breviores, teretes, arcte appressae, demum laxae, marginibus plerumque ciliolatae, ceterum glabrae laevesque, superne raro pubescentes ; ligulae ad seriem ciliorum redactae ; laminae lanceolato-lineares vel lanceolatae, basim abrupte contractam versus attenuatae, acutae vel subacutae, 3–15 cm. longae, 4–12 mm. latae,

planae, firmae, supra arcte nervosae et nervis scaberulis vel laevibus, plerumque pilis appressis paucis aspersae, subtus inter nervos secondarios plerumque 4 vel 5 papillis acutis vel tuberculis piligeris plus minus dense obsitae, pilis brevibus vel elongatis, marginibus cartilagineis minute scaberulis. *Panicula* elliptica, elliptico-oblonga vel latissime ovata, laxissima, 12·5–25 cm. longa, 7·5–15 cm. lata ; rhachis gracilis, laevis vel minute scaberula ; rami oblique patentes, solitarii, gracillimi, laxe divisi, ramulis patentibus, leviter flexuosi, minute scaberuli, inferiores usque ad 12 cm. longi ; pedicelli apice incrassati, inaequales, laterales usque ad 6 mm. longi, terminales usque ad 1 cm. longi. *Spiculae* ambitu late ellipticae vel elliptico-oblongae, e dorso late ellipticae vel obovato-ellipticae, obtusae vel plerumque apiculatae, 1·3–1·8 mm. longae, pallide virides vel stramineae. *Glumae* aequales, spiculae aequilongae, convexae, membranaceae, glabrae pilis minutissimis paucis apicem versus sitis exceptis ; inferior explanata late ovata vel late ovato-elliptica, obtusa, 5–7-nervis ; superior inferiore similis sed latior et 7–9-nervis. *Anthoecium inferum* ♂ or ♀, ambitu semi-ellipticum : lemma late ellipticum, apice rotundatum, 1–1·4 mm. longum, coriaceum, plerumque glabrum, obscure 5-nerve ; palea lemmati aequilonga, glabra. *Anthoecium superum* ♀, infero simile sed leviter brevius et nonnunquam basi et marginibus pilis minutissimis paucis asperum. *Antherae* 0·6 mm. longae.

St. Thomas Isl. : Peak of St. Thomas, at the summit, *Mann* ; Peak of St. Thomas, Macambrara, Lagoa Amelia, St. Nicholas, *Moller* 132 (in part).

Uganda : Toro, 1500 m., *Snowden* 66 ; Masaka, near Mpungwe, in forest-clearing, 1200 m., *Snowden* 1389.

Kenya Colony : Aberdare Range and base of Mt. Kenia, *Dowson* 75 ; Mt. Kenia, *R. E. & Th. Fries* 1727.

Tanganyika Territory : Usambara, Gonja, *Holst* 4242 ; Amani, common in cleared areas in evergreen rain-forest, 900 m., *Greenway* 1671 (type) ; Kilimanjaro, 2100 m., *Johnston* 9 ; Marangu, 2200 m., *Volkens* 1285.

Isachne Gossweileri *Stapf et C. E. Hubbard*, sp. nov. ; affinis *I. kiyalaensi* Robyns, sed spiculis minoribus, laminis linear-lanceolatis differt.

Gramen perenne. *Culmi* ascendentes, usque ad 45 cm. (vel ultra) alti, graciles, teretes, multinodes, glabri laevesque. *Foliorum* vaginae internodiis multo breviores, striatae, laxiusculae, teretes, marginibus ciliolatis, ore pilosae, ceterum glabrae laevesque ; ligulae ad seriem ciliorum redactae ; laminae lineari-lanceolatae, basi contractae, subacutae, usque ad 5 cm. longae, 3-5·5 mm. latae, planae, firmae, virides, supra scaberulae et arcte nervosae, subtus pilis appressis e tuberculis minutis ortis sparse hirsutae, marginibus cartilagineis scaberulis vel fere laevibus. *Panicula* ovata, laxa, 5·5–9·5 cm. longa ; rhachis gracilis, leviter flexuosa, laevis ; rami solitarii, demum patentes, laeves, rigidiusculi, divisi, ramulis

brevibus appressis vel leviter patentibus, inferiores usque 3 cm. longi ; pedicelli apice leviter incrassati, inaequales, 0·5–2 mm. longi. *Spiculae* ambitu late ellipticae vel late ovato-ellipticae, e dorso ellipticae, usque ad 1·5 mm. longae, pallide virides vel purpureo-tinctae. *Glumae* subaequales, spiculae fere aequilongae, explanatae late ellipticae et obtusae vel inferior angustior, convexae, membranaceae, glabrae pilis minutissimis apicem versus sitis exceptis, tenuiter 5-nerves vel superior 7-nervis. *Anthoecium inferum* ♀ vel ♂ : lemma late ellipticum, obtusum, spiculae aequilongum, chartaceum, obscure 5-7-nerve, basi pilis paucis minutissimis exceptis glabrum ; palea lemmati aequilonga, glabra. *Anthoecium superum* ♀, ambitu semi-ellipticum, e dorso late ellipticum et obtusum, minutissime pedicellatum : lemma circiter 1 mm. longum, tenuiter coriaceum, minute pubescens ; palea lemmati aequilonga, glabra. *Antherae* 0·6 mm. longae.

ANGOLA : Cuanza Norte ; sources of the River Bengo, Camabatela, humid situation in shade, *Gossweiler*, 7334.

Isachne guineensis *Stapf et C. E. Hubbard*, sp. nov ; affinis *I. kiyalaensi* Robyns, sed spiculis majoribus hiantibus e dorso anguste ellipticis, laminis lineari-lanceolatis subglaucis differt.

Gramen perenne. *Culmi* ascendentes, e nodis inferioribus radicantes, plus 30 cm. longi, moderate graciles, simplices vel inferne ramosi, subteretes, plurinodes, glabri laevesque. *Foliorum* vaginae laxae, teretes, striatae, glabrae laevesque, inferiores internodiis longiores, superiores breviores ; ligulae ad seriem ciliorum brevium redactae ; laminae lineari-lanceolatae, basi leviter rotundatae, subacutae, usque ad 12·5 cm. longae et 1 cm. latae, planae, firmae, supra laeves et arcte nervosae, subtus minute hispidulae vel glabrescentes, marginibus minute scaberulis. *Panicula* laxa, circiter 7·5 cm. longa ; rhachis gracilis, leviter flexuosa, laevis ; rami laxe divisi, laeves ; pedicelli valde inaequales, laterales usque ad 2 mm. longi, terminales usque ad 8 mm. longi. *Spiculae* hiantes, e dorso anguste ellipticae, circiter 2·5 mm. longae, apice purpureae. *Glumae* subaequales, spiculae fere aequilongae, membranaceae, obscure 5-7-nerves, glabrae pilis minutissimis paucis apicem versus sitis exceptis ; inferior explanata elliptica, obtusa ; superior inferiori similis sed leviter latior. *Anthoecium inferum* ♂ vel ♀ : lemma elliptico-oblongum, obtusum, spiculae aequilongum, firme membranaceum, basi pilis paucis minutissimis exceptis glabrum, obscure 5-nerve ; palea lemmati aequilonga, glabra. *Anthoecium superum* ♀, ambitu late semi-ellipticum, e dorso ovato-ellipticum et obtusum, minutissime pedicellatum : lemma 1·5 mm. longum, tenuiter coriaceum, dorso glabrescente excepto minutissime pubescens ; palea lemmati aequilonga, dorso minutissime pubescens. *Antherae* 1 mm. longae.

FRENCH GUINEA : between Mali and Mt. Loura, in a stream, 1450 m., *Chevalier* 34601.

XXXVI—FASTIGIATE AND PYRAMIDAL LARCHES.

W. Dallimore.

In *K.B.* 1929, 97–105, Mr. W. J. Bean gave an account of numerous trees of fastigiate and pyramidal habit which were growing in the Royal Botanic Gardens, Kew, and later, in the same year, the late Mr. Vicary Gibbs supplemented the article with another (op. cit. 285–287), directing attention to additional kinds that were growing at Aldenham.

The trees enumerated included both broad-leaved species and conifers, but no mention was made of either a fastigiate or a pyramidal larch, and I have not found such trees recorded amongst forms that have been singled out for definite varietal names.

However, within the last year two forms of the European larch, *Larix decidua* Mill. (*L. europaea* DC.), have been found, one with a very definitely fastigiate habit, the other distinctly pyramidal. In addition, a pyramidal form of the American larch, *Larix laricina* K. Koch, has developed at Bedgebury.

The fastigiate form of *L. decidua* is a tree 6½ feet high which was found by Sir Arthur Hill, in May 1932, growing amongst other larches in " The Warren," Mortimer Forest, one of the new forests planted by H.M. Forestry Commission. By the courtesy of Sir Roy Robinson, Chairman of the Forestry Commission, the young tree has been sent to Kew accompanied by two smaller specimens found by Mr. A. P. Long, Divisional Officer, one of fastigiate habit, and the other pyramidal.

The pyramidal form of *L. laricina* is one of six young trees planted at Bedgebury in March 1925. It has been much more compact in habit than the other five from its earliest days, and is now a tree 11 feet high of markedly formal appearance.

In order to place these trees on record they are named as follows :—

Larix decidua forma **fastigiata** *Dallimore*, form. nov. ; a typo habitu fastigiato differt.

A form of European larch identical with the type except in habit. It is an erect tree with a definite central stem from which the branches are borne at a very acute angle, giving it a close and compact habit resembling that of the Lombardy poplar. Sir Arthur Hill had no difficulty in picking out the larger tree from amongst many thousands of European larch by its stiff, formal appearance.

Larix decidua forma **pyramidalis** *Dallimore*, form. nov. ; a typo habitu pyramidale differt.

A European larch differing from the type in habit, and forming an erect tree with a good central stem. The branches are produced almost at right angles, but after growing horizontally for a few inches they turn upwards, forming a branch system of pyramidal outline.

Larix laricina forma **pyramidalis** *Dallimore*, form. nov. ; a typo habitu pyramidale differt.

This form has all the characters of *L. laricina* except habit, which is similar to that of *L. decidua* forma *pyramidalis*.

XXXVII—MISCELLANEOUS NOTES.

I. B. Pole Evans.—We record with pleasure the conferment by the University of the Witwatersrand of the Honorary Degree of Doctor of Science on Dr. I. B. Pole Evans, C.M.G., M.A., D.Sc., F.L.S., Chief of the Division of Plant Industry, Department of Agriculture, Pretoria. The ceremony, which took place in the presence of a large audience in the City Hall at Johannesburg on March 25th, was performed by the Vice-Chancellor, Mr. H. J. Hofmeyr.

Mrs. Popenoe.—We regret to record the death on December 31st, 1932, of Mrs. Wilson Popenoe (Dorothy K. Hughes) at Guatemala City. From 1918–1923 Miss Hughes worked in the Herbarium at Kew as Temporary Technical Assistant, mainly aiding Dr. Stapf in his work on the Grasses. Gifted with keen perception and considerable artistic skill for illustration, she carried out independent research work in her own time and published several papers.

In 1923 she went to America where she took up work in the Bureau of Plant Industry at Washington, D.C., and afterwards married Mr. Wilson Popenoe of the same Department.

The Romance of Plant Hunting.*—All those interested in plant collecting and the enrichment of our gardens will welcome the appearance of Captain Kingdon Ward's well-known book in this cheap and attractive form. An appendix has been added giving the plant names under their field numbers, which should be useful to horticulturists who are cultivating Captain Ward's plants. The text, with its mixture of racy narrative and botanical description, remains unchanged.

*By Captain F. Kingdon Ward. London, Edward Arnold & Co. First published in The Kingfisher Library, 1933. Pp. x + 277. Illustrated. Price 3*s.* 6*d.*

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